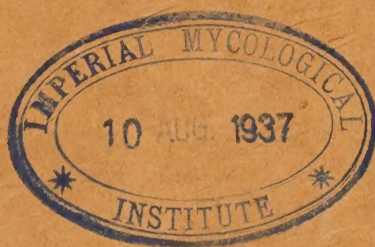


Report of the Work of The Rubber Research Board in 1936.

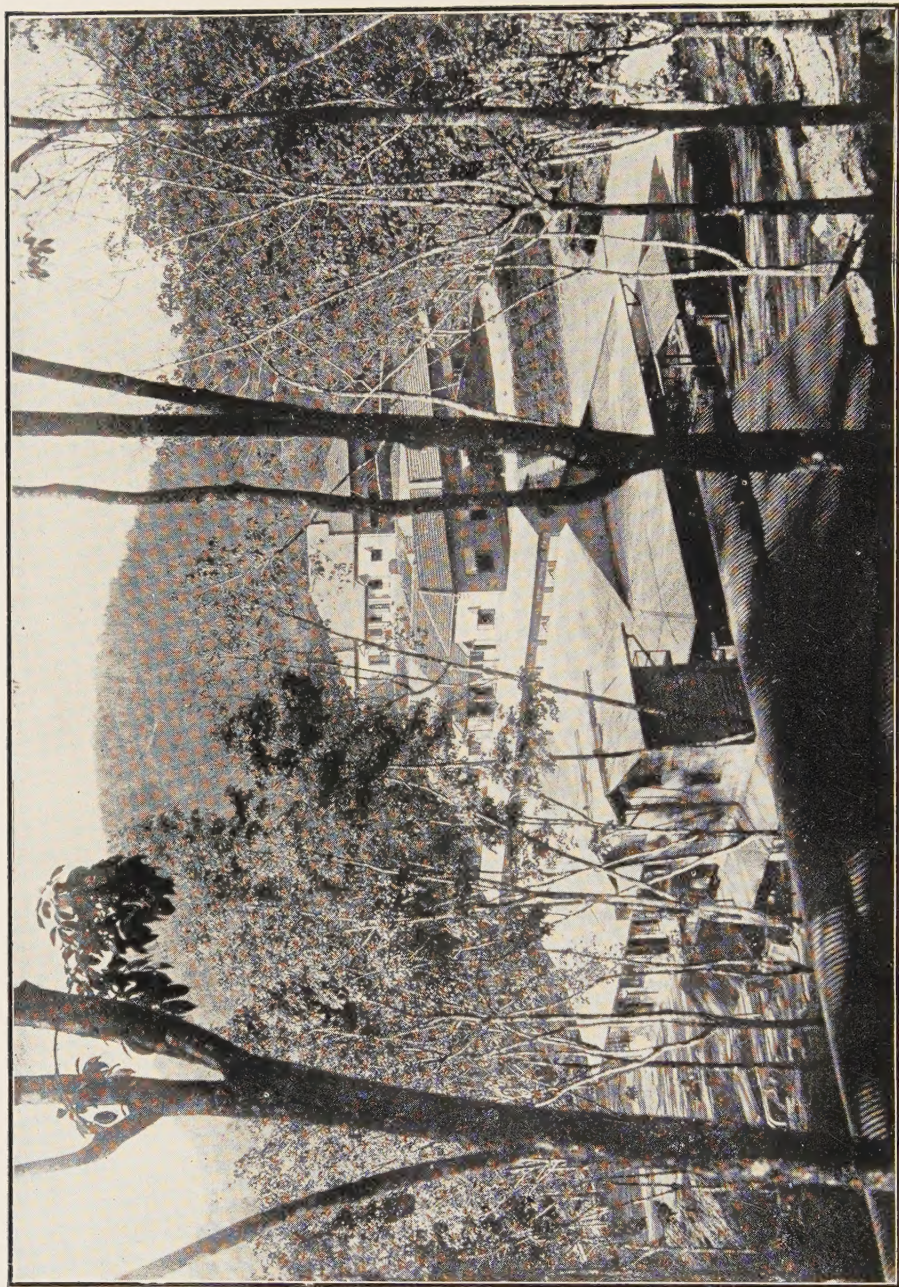
(Established under Ceylon Ordinance No. 10 of 1930).



March, 1937.



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DARTONFIELD ESTATE—THE FACTORY AND LABORATORIES.

REPORT OF THE WORK OF THE RUBBER RESEARCH BOARD IN 1936.

(Established under Ceylon Ordinance No. 10 of 1930.)

The Rubber Research Scheme (Ceylon) was established by Ordinance No. 10 of 1930 which came into force on August 1st of that year. The Board of Management took over the assets and liabilities of a former Research Scheme which was established in 1913 and re-organised in 1921. The present report is the 6th Annual Report of the Research Scheme, as constituted under the Ordinance.

The provisions of the Rubber Research Ordinance are subject to the following amending Ordinances:—

No. 11 of 1934.—Provides that raw rubber brought into the Island for the purpose of re-export shall not be liable for payment of the cess under the Rubber Research Ordinance.

No. 35 of 1935.—Provides for transfer of the lease of Nivitigalakele to the Rubber Research Board.

No. 3 of 1936.—Provides that the Board may apply for, purchase or otherwise acquire patents, brevets d'invention, concessions and the like.

CHAIRMAN'S REPORT

Board Membership.—The three-year period of office of the following nominated members of the Board terminated during the year and appointments to fill the vacancies were made as indicated below:—

Col. T. Y. Wright, April 21st. Re-nominated for a further period of three years.

Col. T. G. Jayewardene, June 26th. Re-nominated for a further period of three years.

Mr. F. H. Griffith, November 15th. Re-nominated for a further period of three years.

Mr. C. A. Pereira, November 16th. Re-nominated for a further period of three years.

Mr. B. F. de Silva, November 25th. Mr. F. A. Obeyesekere appointed.

The following additional changes in the membership of the Board occurred during the year:—

Mr. E. Rodrigo succeeded Dr. J. C. Hutson as Chairman of the Board on his appointment as Acting Director of Agriculture on March 16th.

Mr. L. P. Gapp resigned and was succeeded by Mr. J. C. Kelly with effect from 27th February.

Mr. C. H. Z. Fernando vacated his seat by reason of absence from 3 consecutive meetings of the Board, and Mr. L. M. M. Dias was nominated in his place with effect from 18th May.

Mr. J. L. Kotalawala resigned on his appointment as Minister for Communications and Works and was succeeded by Mr. R. C. Kannangara, M.S.C., with effect from 26th June.

Mr. B. M. Selwyn resumed his seat on return to the Island with effect from 3rd March, relieving Mr. R. Neville Rolfe who was acting for him.

Mr. J. L. D. Peiris was nominated with effect from 18th May to fill the vacancy arising from the decease of Mr. C. E. A. Dias.

Mr. C. E. A. Dias had served on the Board since its inception in 1930 and had been a member of the Executive Committee of the former Research Scheme since 1924. A tribute to his services was paid at a Board Meeting held on May 21st, 1936, and a vote of condolence with his relations was recorded.

The personnel of the Board at the end of 1936 was as follows:—

Ex-Officio Members,

The Acting Director of Agriculture (E. Rodrigo, Esq., C.C.S.)—
Chairman.

Representing the Financial Secretary — The Deputy Financial
Secretary (C. H. Collins, Esq., C.C.S.).

Unofficial Members of the State Council nominated by the Governor.

E. C. Villiers, Esq., M.S.C.
George E. de Silva, Esq., M.S.C.
R. C. Kannangara, Esq., M.S.C.

Nominated by the Ceylon Estates Proprietary Association.

Colonel T. Y. Wright.
J. C. Kelly, Esq.

Nominated by the Planters' Association of Ceylon.

F. H. Griffith, Esq., M.S.C.
B. M. Selwyn, Esq.

Nominated by the Rubber-Growers' Association.

I. L. Cameron, Esq.
E. W. Whitelaw, Esq.

Nominated by the Low-Country Products Association.

J. L. D. Peiris, Esq.
Colonel T. G. Jayewardene, V.D.
Leo B. de Mel, Esq., J.P., U.P.M.
L. M. M. Dias, Esq.

Nominated by the Governor to represent Small-Holders.

C. A. Pereira, Esq.
F. A. Obeyesekere, Esq.

Meetings.—Meetings of the Board were held in Colombo on 19th March, 21st May, 23rd July, 17th September and 12th November. The Board is indebted to the Ceylon Chamber of Commerce for the use of its Committee Room for meetings on several occasions.

Committees.

Experimental Committee.—Mr. F. H. Griffith succeeded Mr. J. L. Kotalawala as Chairman of the Experimental Committee when the latter gentleman resigned from the Board on his appointment as Minister for Communications and Works. The personnel of the Committee at the end of the year was as follows:—

Mr. F. H. Griffith (Chairman).
Col. T. G. Jayewardene.
Mr. F. A. Obeyesekere.
Mr. B. M. Selwyn.
Mr. T. E. H. O'Brien (Convener).

Meetings of the Committee were held on 6th February, 3rd April, 21st May, 22nd June, 13th August, 13th October, 12th November and 7th December.

Small-Holdings Committee.—The following Committee was appointed to advise on Small-holdings work:—

Mr. F. A. Obeyesekere.
Mr. C. A. Pereira.
The Small-Holdings Propaganda Officer.
The Director (Convener).

Meetings of the Committee were held on 28th April and 24th October.

Meetings of *ad hoc* Committees appointed by the Board were held as follows:—

1. Committee on duties of the Director of Research, 3rd April.
2. Committee on terms of service of officers recruited from abroad, 10th October.

London Advisory Committee.—The Board contributed equally with the Rubber Research Institute of Malaya to the cost of research on the utilisation of raw rubber, carried out at the Imperial Institute, London, under the control of the London Advisory Committee for Rubber Research (Ceylon

and Malaya), in accordance with an arrangement to continue the joint contribution pending the consideration of new proposals for financing this work.

In a memorandum received from the Committee the view was expressed, after consultation with the International Rubber Regulation Committee, that the cost of the work at the Imperial Institute was not likely to be met from the cess to be levied for the purpose of propaganda and research on new applications and it was proposed that the Rubber Research Institute of Malaya and the Rubber Research Scheme (Ceylon) should agree to provide funds for the continuation of the work of the Committee for a period of 5 years from January, 1937, on the basis of a 75 per cent. contribution from Malaya (£2,625 per annum) and 25 per cent. from Ceylon (£875 per annum). This proposal was accepted by the Rubber Research Scheme and information has been received that the Rubber Research Institute of Malaya has agreed to contribute on the new basis for 1937.

The London Advisory Committee held meetings on 31st January, 8th May and 16th October.

Meetings of the Technical Sub-Committee were held on the same dates.

Development of the Research Scheme.—The programme of building construction at Dartonfield was carried out according to schedule and the headquarters of the Scheme were transferred from Culloden with effect from November 7th, 1936. Provision has been made in 1937 estimates for carrying out the final stage of the building programme. The Small-Holdings Propaganda Officer remains at Culloden temporarily and will be transferred to Nivitigalakele when quarters have been provided.

The leases of buildings occupied at Culloden estate were formally terminated at the end of the year. Two staff bungalows and two clerks' bungalows were sold to the proprietors of the estate and the other buildings will be demolished. The opportunity is taken of thanking Messrs. The Rosehaugh (Ceylon) Rubber Co., Ltd., for the facilities which have been afforded to the Rubber Research Scheme at Culloden for a number of years.

An area of 10 acres at Dartonfield was replanted under experimental conditions. An area of 5 acres of forest land adjoining Pinnagoda was leased from Government in exchange for 5 acres of less suitable land in the Pinnagoda block and 2 acres of the land was cleared for use as a stock nursery.

Arrangements were made for the sale during 1937 of budwood and budded stumps which will be available from the Pinnagoda nurseries. It was decided to allocate the material *pro rata* to the applications on a sliding scale, giving preference to small-holders by allotting a higher proportion in the case of applications for small quantities.

Recommendations regarding the work to be undertaken by the newly-formed Small-Holdings Department which were made by a Committee appointed for the purpose were adopted by the Board and the Committee

was re-appointed as a standing Committee to advise on small-holdings work. The designation of the Small-Holdings Officer was changed to that of Small-Holdings Propaganda Officer.

In accordance with the recommendations 2 Rubber Instructors were appointed on probation to undertake instructional work in the Kalutara district in order to determine whether such work would really be useful. The officers received a preliminary course of training under the Small-Holdings Propaganda Officer and took up instructional duties towards the end of the year. A clerk and translator was also appointed.

Application was made to the Ministry of Labour, Industry and Commerce for a grant of Rs. 35,000 for the purchase of large scale machinery for the purpose of experimental manufacture of rubber flooring. The conditions on which the Minister is prepared to recommend the State Council to make such a grant, were under consideration at the end of the year. Small scale manufacture and sale of rubber tubing were undertaken as a demonstration of the practicability of local manufacture of vulcanized products.

Oidium Leaf Disease.—A campaign of sulphur dusting of small estates and holdings was carried out over an area of approximately 1,000 acres in the Kandy district under the supervision of the Small-Holdings Propaganda Officer. The cost of the campaign was defrayed from a vote of Rs. 20,000 from the Rubber Restriction Fund and its purpose was to demonstrate the efficacy of the treatment and to gain experience of the type of organization required for the treatment of a large number of comparatively small areas.

The campaign was carried out satisfactorily and the Board reached the conclusion that the Rubber Research Scheme having investigated the disease, demonstrated an effective means of control and given practical advice and assistance in the execution of the treatment, had fulfilled its obligations to all classes of producers, and that any further action as regards organised measures should now be left to Government.

A Bulletin was issued embodying a report on the campaign and the report of the Committee appointed by the Board in 1935. Copies were submitted to the Minister for Agriculture and Lands, and to the Chairmen of the Central Board of Agriculture, the Ceylon Estates Proprietary Association, the Low-Country Products Association, the Planters' Association of Ceylon and the Ceylon Association in London.

STAFF.

Director and Chemist.—Mr. T. E. H. O'Brien was on leave from February 19th to October 19th and was re-engaged for a further period of 4 years and 2 months from the latter date. Mr. R. K. S. Murray acted as Director during his absence.

The designation of the post was altered from Director of Research to Director.

Assistant Chemist.—Mr. M. W. Philpott was in charge of chemical work during the year.

Botanist and Mycologist.—On the return of the Director Mr. R. K. S. Murray proceeded on a two months' tour of Malaya and the Dutch East Indies for the purpose of obtaining information regarding the yields of budgrafted Rubber in commercial practice and studying general agricultural conditions. The opportunity is taken of acknowledging the Board's indebtedness to the Officers of the Rubber Research Institute of Malaya, the Algemeen Proefstation of the Algemeene Vereening van Rubber Planters ter Oost Kust van Sumatra (A.V.R.O.S.) and the Proefstation West Java and to numerous commercial organisations in Malaya, Sumatra and Java for the great assistance given to Mr. Murray during his tour.

It was decided to offer Mr. Murray re-engagement for a period of 4 years and 2 months from 12th August, 1937 when his present agreement will terminate.

Assistant Botanist.—Mr. C. A. de Silva continued duties in this capacity.

Small-Holdings Propaganda Officer.—Mr. W. I. Pieris was occupied for the first five months of the year in supervising the sulphur dusting campaign in the Kandy district. He then took up the work of organising the Small-Holdings Department.

Estate Superintendent.—Mr. D. L. Nicol continued his duties as Superintendent of Dartonfield estate and Nivitigalakele.

A Committee considered the terms of employment of officers recruited from abroad in relation to salary, period of engagement, and leave and made recommendations which were adopted by the Board.

FINANCE.

Income for the year amounted to Rs. 177,686.30 which was mainly derived from the cess of $\frac{1}{8}$ cent. per lb. levied on exports of raw rubber under the Rubber Research Ordinance. Income was again adversely affected by the curtailment of exports under the Rubber Restriction Ordinance but the increased export quota allowed for 1937 will materially improve the position.

Monthly cess collections were as follows:—

January	...	...	Rs. 16,256
February	...	...	„ 11,011
March	...	...	„ 10,835
April	...	...	„ 9,642
May	...	...	„ 7,738
June	...	...	„ 9,456
July	...	...	„ 11,498
August	...	...	„ 10,111
September	...	...	„ 14,592

October	...	...	Rs. 16,067
November	...	...	,, 13,235
December	...	...	,, 10,092
		Total	<u>Rs. 140,533</u>

A profit of Rs. 26,264·68 was derived from the normal working of Dartonfield estate and Rs. 5,779·91 from Nivitigalakele, inclusive of the proceeds of sale of surplus rubber coupons.

A sum of Rs. 6,500 was realized from the sale of buildings at Culloden. The book value of the remaining buildings has been adjusted to a figure representing the value of materials and the difference, amounting to Rs. 28,196·84 after crediting the proportion of the Depreciation Fund relating to the buildings written off.

Current expenditure amounted to Rs. 131,980·81, leaving a surplus for the year of Rs. 45,705·49. Capital expenditure amounted to Rs. 113,422·85, including the following items: Part payment for Administrative offices and extension of Chemical Laboratory Rs. 14,899·51; Botanical Laboratory Rs. 18,678·11; part payment for 3 Senior Staff bungalows Rs. 34,156·90; part payment for Chief Clerk's bungalow and 4 Junior Staff bungalows Rs. 17,623·81; estate lines (8 rooms) Rs. 2,849·34; cart road extension Rs. 3,582·12; replanting Rs. 2,775·25. A sum of Rs. 4,669·21 was expended on the development of Nivitigalakele.

The accounts of the Scheme have been examined by the Auditor-General and his certificate and report, together with the income and expenditure account and the balance sheet are appended.

The Reports of the Director and Chemist; Assistant Chemist; Botanist and Mycologist; Assistant Botanist; Small-Holdings Propaganda Officer; and Estate Superintendent are attached. The Report of the London Advisory Committee for Rubber Research (Ceylon and Malaya) will be submitted when available.*

E. RODRIGO,
Chairman of the Board,
Rubber Research Scheme (Ceylon).

11th February, 1937.

* The Report has since been received and adopted by the Board and is also appended.

REPORT OF THE DIRECTOR AND CHEMIST FOR 1936.

STAFF.

The Technical Staff was depleted during the greater part of the year. The Director was away from the Island on leave for 8 months during which period Mr. R. K. S. Murray was in charge of the work of the Scheme. On the return of the Director, Mr. Murray proceeded on a 2 months' visit to Malaya and the Netherlands East Indies. Under these circumstances research work during the period under review was limited and was mainly in the hands of Mr. M. W. Philpott, Assistant Chemist, and Mr. C. A. de Silva, Assistant Botanist.

Mr. W. I. Pieris, Small-Holdings Propaganda Officer, was occupied during the first 5 months in connection with the sulphur dusting campaign in the Kandy District. On completion of this work he undertook the inauguration of the work of the Small-Holdings Department.

A summary of the year's work is given below and further particulars are available in the Reports of the technical officers which are attached:—

TRANSFER OF HEADQUARTERS.

The transfer of Headquarters to Dartonfield was effected on November 7th and the advantages of centralisation have already been greatly appreciated both by the staff and by visitors. The Small-Holdings Propaganda Officer remains at Culloden for the present. It has been decided that his office should be at Nivitigalakele as being more accessible to small-holders than Dartonfield and he will be transferred there when quarters are available.

Buildings erected during the year were as follows:—

Chemical and Administrative block: forming an extension of the Chemical Laboratory erected in 1934.

Botanical block.

Three Senior Staff bungalows (including two started in 1935).

Chief Clerk's bungalow.

Four Junior Staff bungalows (one not completed at end of year).

Eight room lines for estate labourers.

A coagulating shed and small smokehouse were constructed at Nivitigalakele.

Plans and photograph of the laboratories are attached to the report for the information of those interested.

Buildings to be erected in 1937 comprise Director's bungalow, Secretary's bungalow, estate office and one Junior Staff bungalow at Dartonfield and one Senior and one Junior Staff bungalow at Nivitigalakele.

CHEMICAL SUBJECTS.

Rubber Flooring Compositions.—In the Report for 1935 it was stated that experimental work on rubber flooring compositions containing coir dust as the main bulking ingredient had been carried to a stage at which the continuation of the trials on a larger scale was considered desirable. An application was made by the Research Board to the Ministry of Labour, Industry and Commerce for a grant to cover the cost of machinery for the purpose and the terms on which the Ministry is prepared to recommend Government to make such a grant are at present under discussion.

In the meantime attention has been turned to problems connected with laying the material in tile form under the conditions which would usually be met with locally, namely, on comparatively damp cement sub-floors. Tiles laid without an adhesive soon worked loose owing to swelling resulting from moisture absorption and a proprietary adhesive which was tried did not anchor them effectively. A comparison of moisture absorption properties showed that compositions containing coir waste absorbed considerably more moisture than those with mineral fillers. By suitable compounding the moisture absorptive capacity was substantially reduced but this did not eliminate the tendency of the tiles to work loose after laying.

The successful use of rubber tiles under local conditions will probably depend on whether an effective waterproof adhesive can be found, or the replacement of coir by mineral fillers. The alternative is the linoleum type of rubber flooring which is cheaper to manufacture but is less suitable for small scale production.

Crumb Rubber.

(a) **Nitrite Crumb.**—Approximately six tons of this material were prepared at Dartonfield during the year and shipped to London, mainly for experimental work connected with its incorporation in asphalt for road surfacing. The effect of a small proportion of latex in asphalt is to improve the non-skid properties of road surfacing compositions by reducing the movement of the asphalt to the surface. An experimental section of road-way surfaced with the material which was inspected by the writer while on leave had retained a useful matt surface after 12 months' use. It is understood that latex may prove equally satisfactory and easier to incorporate than nitrite crumb so that the possibility of a future demand for the latter product for this purpose remains doubtful.

A minor use to which nitrite crumb is being put is in the preparation of a plastic composition for laying white traffic lines on roads. The composition is being used fairly extensively in parts of England in preference to painted traffic lines but the tonnage of crumb rubber likely to be required for the purpose is relatively small.

The technique of the method for preparing nitrite crumb was developed during the year by the installation of a high speed stirrer for breaking up the spongy coagulum and a hydro-extractor for washing and removal

of surplus moisture from the crumb before it is passed through the disintegrator. Both items of equipment have given good results and it is considered that a sound technical process is now available for preparing the material on a commercial scale, should an extended demand arise.

(b) **“Stearate” Crumb.**—Crumb rubber prepared by the patented process in which wet crepe rubber containing a small proportion of stearic acid is converted to crumb in a disintegrator was examined as a starting point for preparing a softened form of rubber. Preliminary trials showed that the material softened rapidly on heating at 100°C in contrast to crepe which is relatively unaffected by this treatment. When compared, however, with commercial softened rubber, prepared by the method of Ungar and Schidrowitz, the manipulative properties of the product were disappointing and it was concluded that the treatment shows little promise as a means of producing softened rubber suitable for manufacturing purposes.

Latex.

(a) **Latex Shipment.**—One consignment of 500 gallons ammoniated latex was prepared at Dartonfield during the year. A London firm has arranged to accept shipments from the estate whenever available and is prepared to take shipments from other local estates provided that the method of preparation recommended by the Research Scheme is followed. At the present premium of 1½d. per lb. over the current price of smoked sheet latex shipment (in kerosene tins) is barely profitable.

(b) **Vulcanized Latex.**—A series of samples of vulcanized latex, prepared by allowing freshly ammoniated latex to stand in contact with dispersed vulcanizing materials, was forwarded to London for examination. The samples were reported to be overcured and a further series was prepared using a smaller proportion of accelerator.

(c) **Concentrated Latex.**—A small scale concentrator designed by the staff of the London Advisory Committee for concentrating latex by evaporation was received towards the end of the year. It has given promising results in London with old preserved latex and will now be tried out with freshly treated material.

Rubber Paints.

(a) **Melted Rubber Paint.**—The iron roofs of various minor buildings at Dartonfield were treated with paint samples prepared from melted rubber approximately as described in last year's Report, the proportions of ingredients being varied for different buildings. Most of the roofs were in fairly good condition after 8 months and it was concluded that paint suitable for rough outside use could be made on estates for about Rs. 3 per gallon.

(b) **Oxidised Rubber Paint.**—Trials were made with paint samples prepared according to a method patented by the Rubber Growers' Association in which rubber is added in the form of a 50 per cent. solution of milled oxidised rubber in white spirit. Panels which were exposed to the weather for 6 months showed that good ageing properties were obtainable even with paints containing a fairly large proportion of rubber. This class

of paint is a much more promising product than that prepared from melted rubber. Trials will be carried out on a larger scale when opportunity occurs.

Melted Rubber for Road Surfacing.—The possible use of waste scrap rubber on estates for road surfacing has ceased to be of practical interest owing to the increased value of the material. Two corners on one of the roads at Dartonfield were surfaced with melted rubber during the year as a demonstration of the method. A moderately satisfactory surface was obtained if the rubber was heated to the correct extent.

Some trials were made on the preparation of aqueous emulsions of melted rubber and a method was found by which stable emulsions could be prepared containing up to 85 per cent. of solids. It is doubtful whether the material would be of practical interest under present conditions.

Latex Sieves.—Sieves of stainless steel, monel metal and brass have been used alternately at Dartonfield factory for the last 21 months with a view to comparing the wearing properties of the materials. The brass gauze failed recently but the others are still in good condition. Monel gauze is slightly more than twice the price of brass but the extra cost is shown to be at least partly balanced by its better wearing properties.

Formic Acid.—Samples of formic acid obtained from a number of estate suppliers were examined. In each case the strength of the acid found by analysis agreed closely with the declared strength. All the samples except one were supplied as 90 per cent. grade, the exception being supplied as 85 per cent. The vendors of the latter sample have since stated that they are considering changing over to the 90 per cent. grade which is the present accepted standard.

Manufacture of Vulcanized Goods.—Rubber tubing was manufactured at Dartonfield on a small commercial scale as a demonstration of the possibility of local manufacture of vulcanized rubber goods. Approximately 1,000 feet was sold, mainly to the Colonial Storekeeper for use in Government Laboratories. Since the end of the year the Board has decided that the manufacture of other small vulcanized articles should be taken up as opportunity occurs.

LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA).

Personal contact with the officers of the London Advisory Committee at the Imperial Institute was renewed by the Director while on leave in England. Several visits were made to the laboratories and the work in progress there and in Ceylon fully discussed. A meeting of the Technical Sub-Committee of the Advisory Committee was also attended.

The usual official co-operation was maintained with the Committee by the exchange of reports and by correspondence and the Secretary continued to act as agent for the purchase of equipment and chemicals required in Ceylon.

As mentioned in an earlier paragraph a latex concentrator designed by the Imperial Institute Staff was supplied for experimental work in Ceylon. Equipment for testing the tensile strength, viscosity, and stability of latex was also supplied to enable comparable tests to be carried out in both laboratories.

BOTANICAL AND MYCOLOGICAL SUBJECTS.

Oidium and Phytophthora Leaf Fall.—Oidium leaf fall was less severe than in the previous year in all districts except those at the highest elevation. The mild incidence of the disease was particularly marked in the low country districts where the majority of trees refoliated during hot dry weather which was unfavourable to the spread of the fungus. Late wintering trees were, however, severely infected.

The effect of the favourable climatic conditions was to promote the setting of seed and the formation of good foliage in most localities and the effects of sulphur dusting which was carried out extensively on low country estates for the first time, were not as marked as they would have been if the disease had been more active.

The South West monsoon was a severe one and the effect of this in conjunction with the mild incidence of oidium was a serious attack of Phytophthora leaf and pod disease. In general dusted estates suffered most but untreated areas were also affected. Mr. Murray estimated that the majority of estates in the Kalutara district lost 25 to 50 per cent. of their foliage.

The inter-relation between the two diseases and the future attitude to be adopted in regard to sulphur dusting in districts susceptible to Phytophthora attack are fully discussed in the Report of the Botanist and Mycologist. The conclusion is reached that estates which normally experience appreciable oidium leaf fall should have the necessary equipment available to carry out sulphur dusting if a severe attack occurs. The aim in such cases should be to obtain sufficient control of the disease to prevent serious leaf fall while permitting the fungus to attack the highly susceptible flowers.

A preliminary dusting experiment was carried out in which a number of trees were dusted with a series of mixtures of sulphur and copper compounds to test the possibility of causing blossom damage without injuring the young leaves. The results were negative but the trials are to be repeated, an improved technique being used.

A campaign of demonstrational sulphur dusting was carried out over an area of approximately 1,000 acres of small estates and holdings in the Kandy district with the aid of a grant of Rs. 20,000 from the Rubber Restriction Fund. The work was efficiently carried out by the Small-Holdings Propaganda Officer and is discussed in his Report and that of the Mycologist and Botanist.

Budgrafting.—Test tapping was continued at Nivitigalakele and on various estates which are co-operating with the Scheme in the keeping of records. Several of the new local clones brought into tapping at Nivitigalakele are considered to show great promise.

Records of the yields of young trees of imported clones were received from a number of estates. An article summarizing the results for 1935 was issued in *Second and Third Combined Quarterly Circulars* for 1936. In general the yields follow those obtained from trees of the same age in the country of origin.

Girth measurements of trees of imported clones planted at the Iriyagama Division of the Experiment Station, Peradeniya are reproduced in the Botanist's Report. Although these trees are backward for their age they have grown well in the past year. Tjirandji 1 continues to head the list as the best growing clone. These records are of special interest to the Research Scheme as a division of work was arranged some years ago whereby the testing of foreign clones should be carried out at Peradeniya while Nivitigalakele was reserved for testing local mother trees.

A further trial was made at Dartonfield on budding mature trees. Only 3 successes were recorded out of a total of 58 trees budded, confirming the view that this method of rejuvenation is quite unpracticable.

Arrangements were made by the Board for the sale during 1937 of budded stumps and budwood which will be available from the Pinnagoda nurseries. Orders have been booked up to the present for approximately 9,000 budded stumps and 3,000 yards budwood. The quantities are relatively small but they are made up of a large number of small orders, resulting in a considerable amount of extra administrative work. The prices were fixed at 25 cents per stump and 50 cents per yard of budwood. Applications for material (in the case of stumps) greatly exceeded the supply.

Field Experiments.

The field experiments which were provided for in a programme prepared before the purchase of Dartonfield estate have now been laid down. They are referred to in some detail in the Mycologist's and Botanist's Report and the progress made will only be briefly summarized here.

(a) **Mature Rubber.**—The preliminary uniformity trial of a tapping experiment was started in April and the experiment proper will start after the wintering period in 1937. It is designed to compare 11 systems or variations of systems of tapping and is to be continued over a full cycle of bark renewal.

The uniformity trial of a manurial experiment was completed at the end of 1936 and the first application of manure was made in December. The purpose of the experiment is to study the effects of nitrogen alone and together with potash and phosphoric acid.

An area of 20 acres was set aside at the beginning of the year for a trial of the so-called "forestry" system of cultivation. Up to the present this has only entailed the cessation of weeding, except for the removal of grasses on one or two occasions and a survey of the flora which was carried out by the Assistant Botanist.

(b) **Replanted Areas.**—The 7-acre area replanted in 1934 is laid out for the purpose of comparing 3 methods of clearing the land, and the effects of 4 species of ground cover and 2 methods of treatment of the cover on the growth of the plants. Height and girth measurements taken 2 years after planting show that development is satisfactory for the age of the plants but the treatments have not had a significant effect on growth up to the present.

An area of 13 acres replanted in 1935 is laid out in the form of a manurial experiment to study the fertiliser requirements of young budded trees on replanted land. Heights of the plants measured after one year show no significant treatment differences.

An area of 10 acres was replanted in 1936 for the purpose of comparing 3 methods of opening the land, 3 methods of establishing the new stand of trees, and the effects of manuring with organic and inorganic mixtures.

SMALL-HOLDINGS DEPARTMENT.

It is more than 2 years since it was decided to transfer Mr. W. I. Pieris to the newly created post of Small-Holdings Officer (designation since changed to Small-Holdings Propaganda Officer) but he was unable to relinquish other duties until the appointment of an Assistant Botanist in September, 1935. Mr. Pieris then made a visit of 2 months' duration to Malaya to study the organisation of small-holdings work in that country. During the first 5 months of 1936 he was engaged in the supervision of the sulphur dusting campaign in the Kandy district and it is only during the latter part of this year that his undivided attention could be given to the formation of a Small-Holdings Department.

The general lines of work which were recommended by a Committee appointed to consider the subject and which were adopted by the Board, are as follows:—

1. The collection of data regarding the existing conditions on small-holdings. This is regarded as an essential preliminary to future advisory work.
2. Demonstrations of the correct methods of tapping, preparation of rubber, treatment of diseases, budgrafting, replanting etc.
3. Issue of leaflets giving information on the above subjects.
4. Lectures illustrated by lantern slides and/or cinematograph films.
5. Competitions.

The Committee decided that Rubber holdings and estates up to a maximum of 30 acres in extent should come within the purview of the Department.

The work of the Department is regarded by the Board for the present as being in the nature of an experiment and its permanence and future expansion will depend on the extent to which its activities are found to be of value to the class of producer whom it is intended to assist. Indications during the very short period that instructional work has been in progress are that there is a very substantial demand among small-holders for information which they have not previously known how to obtain.

It was decided to start instructional work in the Kalutara district and 2 Rubber Instructors were appointed in August for a probationary period of one year. After a 3 months' course of training under the Small-Holdings Propaganda Officer, they were stationed at Matugama and Horana respectively. Very successful and well attended inaugural meetings of small-holders were held in these villages.

Reference is made in the Report of the Small-Holdings Propaganda Officer to the work carried out to date in connection with the preparation of a bulletin on replanting, the designing of a smokehouse for small-holders, and an enquiry into marketing conditions etc.

DARTONFIELD ESTATE.

The tappable area was reduced by 10 acres which was cleared for replanting. In addition a total of approximately 1,000 trees has been removed during the past 2 years for the provision of road and building sites and the present tappable area may be taken as the equivalent of 130 acres. It will be necessary to have the estate surveyed next year when the building programme is completed.

Crop for the year amounted to 74,704 lbs. compared with an estimate of 80,000 lbs. This represents a decline in yield of approximately 60 lbs. per acre which is mainly attributed by the superintendent to the effects of secondary leaf fall during the South West monsoon. Tapping was continued on the "double 4" system except in the area reserved for the tapping experiment where the uniformity trial was carried out on the alternate day (single half spiral cut) system.

The crop was mainly prepared in the form of crepe and smoked sheet which were sold in Colombo and were well reported on. About 6 tons of nitrite crumb were despatched to the London Advisory Committee and a consignment of 500 gallons of ammoniated latex was sold in London.

The incidence of oidium leaf disease was very mild. - Three full rounds of sulphur dusting were carried out at an average of 4 lbs. sulphur per acre and a partial round at 2 lbs. per acre. In common with other properties in the district the estate suffered severely from secondary leaf fall

during the South West monsoon. Cases of dieback caused by *Phytophthora* in the 1935 clearing were controlled by treatment with Bordeaux mixture. One case of root disease and a few cases of *Ustilina* occurred.

The whole estate was planted with *Pueraria Phaseoloides* but as this was done on an experimental basis to compare different planting methods, the growth has been variable. Selective weeding was carried out, all species being allowed to grow except grasses, bracken, mikania and "Iluk". An area of 40 acres was forked and manured as part of a regular cultivation programme.

Reference to the replanting and other field experiments is made elsewhere in the Report. All normal field works in the experimental areas were carried out by the estate superintendent.

The estate cart road was extended from the staff bungalow sites to join the existing road at the entrance to the estate, forming a circular inspection road which gives easy access to most of the experimental areas.

Major building works were carried out on contract but day-to-day supervision was exercised by the estate superintendent. He was also responsible for the construction of an 8 room line and an estate temple.

The Visiting Agent, Mr. P. R. May, inspected the estate on 11th March and 29th September. His reports were generally satisfactory but he advised an acceleration of the manuring programme.

NIVITIGALAKELE.

A coagulating shed and smokehouse of the small-holder's type were constructed and trees in the 1926 and 1927 areas which were not required for test tapping were brought into commercial tapping. A crop of 5,345 lbs. was secured. This was partly in the form of smoked sheet and partly blanket crepe prepared by remilling the test tapping samples.

The station was manured during the year. Sulphate of ammonia was applied in the 1926 and 1927 clearings and an inorganic mixture in the 1928 clearing. The growth of leguminous covers has deteriorated in the older clearings as a result of the increasing shade and an application of phosphatic manure which was broadcast during the year has not led to much improvement. Weeding is done on a selective basis as at Dartonfield.

Growth of budded stumps in the 1935 clearing was satisfactory but development of the seedlings was disappointing, with the result that budding of these plants could not be completed during the year as was intended. Budding results in the budwood multiplication nursery were disappointing and this will lead to less material than was anticipated being available for sale to estates during 1937.

An area of 2 acres of forest was cleared and laid out as beds for a stock nursery for subsequent supply of budded stumps to estates. It was not fully planted owing to shortage of seed but seed has since been obtained from the Moneragalla district.

ADVISORY SERVICES, CORRESPONDENCE, ETC.

The demand for advice on agricultural subjects continued on an extensive scale during the year. The enquiries mainly related to problems connected with budding and replanting but there was also considerable correspondence in connection with manuring, tapping, cover crops, Oidium and Phytophthora leaf fall etc. Requests for advisory visits were numerous but the majority of them had to be refused owing to the depleted scientific staff. In cases where advisory visits could not be made superintendents were usually able to obtain the required assistance either by correspondence or by a visit to Dartonfield for discussion of their problems in relation to the experimental work in progress. In a departmental report Mr. Murray mentions that superintendents frequently brought their entire replanting programme and estimates to be "vetted". Estimates depend largely on local conditions and are more properly a matter for discussion with visiting agents than scientific officers, but it is a sign of confidence that the advice of the Research Scheme should be sought on this aspect of replanting.

On the chemical side enquiries were again much less numerous than those relating to agricultural subjects but showed a revival of interest in factory matters compared with the previous year. Apart from routine enquiries connected with defects arising during manufacture, enquiries were dealt with in connection with latex shipment, equipment for sheet and crepe manufacture, smokehouse and crepe drying house design, crumb and powdered rubber, and manufacture of a variety of vulcanized products etc. The necessary information was given to an enquirer to enable him to make up a tyre retreading compound locally.

Reports were furnished to the Director of Commercial Intelligence in connection with rubber powder and rubber flooring and to the Coconut Board in connection with the suggested use of vinegar as a coagulant.

Arrangements were made for regular visitors' days at Dartonfield. The estate superintendent is now available every Wednesday and the technical officers on the 2nd and 4th Wednesdays of each month. Visitors are welcomed at other times but any particular member of the staff may not be free to give them attention unless an appointment has been made. The arrangement has worked well and proved a convenience both to visitors and the staff. The visitors' book was signed by 150 people during the year but this figure does not represent the full number of visitors. Among notable visitors to the estate during the year were: the Minister and Executive Committee for Labour, Industry and Commerce; the Minister for Agriculture and Lands; the Government Agent, Western Province; Mr. C. E. T. Mann of the Rubber Research Institute of Malaya; Dr. P. Ungar, and Dr. P. J. S. Cramer.

MEETINGS, COMMITTEES, ETC.

The Director was present at meetings of the Board of Management by invitation and attended the meetings of the Experimental Committee

and other Sub-Committees. General meetings of the Kalutara Planters' Association were attended by one or more members of the staff.

The Director is an *ex-officio* member of the Central Board of Agriculture, two meetings of which were attended at Peradeniya during the year. Mr. Murray acted as a member of the Budded Rubber Assessment Board involving attendance at 8 meetings.

CO-OPERATION WITH OTHER RESEARCH ORGANISATIONS.

Close co-operation was maintained with the Rubber Research Institute of Malaya, the Rubber Growers' Association and the Rubber Producers' Research Association by the exchange of reports and by correspondence.

Mr. C. E. T. Mann, Head of the Botanical Division, Rubber Research Institute of Malaya, made a 2 weeks' visit to Ceylon and carried out a programme of visits to estates arranged by the Research Scheme. Mr. H. J. Page and Col. B. J. Eaton, Director and retiring Director of the Rubber Research Institute of Malaya, were met by the Acting Director when they passed through Colombo.

The tour of Malaya, Sumatra, and Java which was made by Mr. Murray in the latter part of the year enabled him to meet and discuss matters of mutual interest with the officers of the Rubber Research Institute of Malaya, the Proefstation of the A.V.R.O.S. (Sumatra) and the Proefstation West Java. We are greatly indebted to the Directors of these Institutes for the assistance given to Mr. Murray and the trouble taken in arranging itineraries for him. It is believed that the personal contacts which have been established will lead to more active collaboration with research organisations in other rubber producing countries than has hitherto been effected.

While the Director was on leave in England the opportunity was taken to meet officers of the Rubber Growers Association and the Director of the Research Association of British Rubber Manufacturers.

Altogether the year has been a fruitful one in regard to the promotion of co-operation between our own and other Institutes working on similar problems.

PUBLICATIONS.

The number of estates registered to receive the Scheme's publications in 1936 was 326, compared with 336 in 1935. The decrease is due to the fact that a number of estates omitted to renew their applications for registration in spite of a reminder being enclosed in the last publication issued each year.

Publications issued during the year were as follows:—

Annual Report and Accounts 1935.

Bulletin No. 53.—Oidium Leaf Disease,

First Quarterly Circular.

Replanting of Rubber. By R. K. S. Murray.

Coir as a Constituent of Rubber Flooring Materials. By M. W. Philpott.

Latex Shipment. By M. W. Philpott.

The Utilisation of Rubber Latex for Road Surfacing. By the London Advisory Committee.

Minutes of the 29th, 30th and 31st Meetings of the Rubber Research Board.

2nd and 3rd Combined Quarterly Circulars.

The Performance of Imported Clones in Ceylon—I. By R. K. S. Murray.

Ceylon Clones—IV. By R. K. S. Murray.

Field Experiments on Dartonfield Estate. II.—Manuring Experiment with Mature Rubber. By C. A. de Silva.

Field Experiments on Dartonfield Estate. III.—Replanting. By C. A. de Silva.

Control of Oidium on Small Rubber Estates in 1936. By W. I. Pieris.

Minutes of the 32nd and 33rd Meetings of the Rubber Research Board.

Fourth Quarterly Circular.

Field Experiments on Dartonfield Estate. IV—Replanting 1936. By C. A. de Silva.

The Work of the Ceylon Rubber Research Scheme. By T. E. H. O'Brien.

The Tapping of Budded Trees.

Diseases and Pests of the Rubber Tree.

Rubber Latex.

Minutes of the 34th and 35th Meetings of the Rubber Research Board.

T. E. H. O'BRIEN,

Director,

Rubber Research Scheme (Ceylon).

Research Laboratories,

Dartonfield, Agalawatta,

19th February, 1937.

ASSISTANT CHEMIST'S REPORT FOR 1936.

The erection of new buildings and the transfer of the headquarters of the Scheme from Culloden to Dartonfield severely handicapped the work of the Chemical Department during 1936.

The main part of the extension to the chemical wing is a laboratory which is to be devoted to the physical testing of raw and vulcanised rubber. At the end of the year all the building work was finished, the chemical stock had been taken over from Culloden and the physical testing apparatus was being installed in the new laboratory.

The experimental work of the department was mainly on subjects connected with the utilisation of rubber. In the absence of the Director on leave the writer attended to enquiries on chemical subjects.

The following is a summary of the progress achieved in the investigations dealt with during the year:—

Utilisation of Coir Residues.—The experiments carried out in 1935 on the production of a flooring material containing coir waste are described in the report for that year and in the Rubber Research Scheme *Quarterly Circular* for April, 1936. The position at the beginning of the year was that the investigation was reasonably complete as far as laboratory trials on the manufacture of the material were concerned and that further developments would have to await the provision of facilities for production on a larger scale. A scheme for the semi-commercial manufacture of the material which was placed before the Executive Committee of Labour, Industry and Commerce early in the year, is still under consideration.

Meanwhile attention was directed towards the laying of the flooring. This proved to be a much more difficult problem than had been expected. The coir-rubber tilings were laid on a cement floor (a) without an adhesive (b) with a proprietary rubber flooring adhesive and (c) without an adhesive but with an application of bitumen to the floor. In every case the tiles worked loose after one or two weeks on account of the expansion caused by water absorption from below. An examination was therefore made of the water absorptive properties of the material in comparison with those of other types of rubber flooring. The following figures are the percentages of water taken up by a number of samples after 4 days' immersion at room temperature:—

C29/2 (tiling containing coir)	...	3.3 per cent.
C29/2A (tiling containing wood flour)	...	2.2 " "
Green tile (manufacturer A)	...	0.9 " "
Buff tile (manufacturer A)	...	0.9 " "
Green sheet (manufacturer B)	...	0.6 " "
Purple sheet (manufacturer B)	...	1.4 " "

Brown sheet (manufacturer B)	...	0.4 per cent.
Red sheet (manufacturer B)	...	0.3 „ „
Dark Brown sheet (manufacturer B)		0.4 „ „

It was evident from these figures that the water absorption of the coir product was distinctly high. A large number of tilings of modified composition were therefore made to determine the factors mainly responsible for this defect. From the results of the absorption tests it was possible to draw the following conclusions:—

- (1) The main source of high water absorptive capacity was the coir itself.
- (2) The inclusion in the composition of certain resins and waxes tended to decrease the water absorption.
- (3) The state of cure had little influence on water absorption.

By replacing part of the coir by mineral fillers and introducing a proportion of a suitable wax such as carnauba wax it was found possible to reduce the water absorptive capacity of the tiling very markedly. The extent of the reduction effected is illustrated by the following figures:—

Days Immersion	Percentage Absorption.				
	2	4	8	20	55
Original coir tiling					
C29/2	2.41	3.64	5.45	8.23	13.2
Modified coir tiling					
C32/7	0.53	0.84	1.22	1.93	3.30
Modified coir tiling					
C35/5	0.54	0.73	1.09	1.55	3.40
Typical commercial tiling	0.51	0.69	0.97	1.19	1.85

It was expected that this improvement would be sufficient to overcome the difficulty of laying the material but a trial area of the modified tiling C32/7 on "dry" cement showed little less tendency than the original composition to take up moisture from the sub-floor and in fact worked loose after about 4 weeks.

In view of the failure that has attended every attempt to lay this flooring under local conditions it may be necessary (1) to omit the fibrous filler entirely from the composition or (2) reconsider the possibility of making coir-rubber flooring in sheet form. In connection with the latter it is interesting to note that although the water absorptive capacity of the sheet material is very high (20.3 per cent. absorption after 4 days immersion) it is considerably less than that of several samples of linoleum that were examined.

CRUMB RUBBER.

(a) **Nitrite Crumb.**—About six tons of this grade of rubber were prepared at Dartonfield during the year. Most of this was supplied to a firm of manufacturers of road compositions who are conducting experiments on the use of rubber in bituminous asphalts for road surfacing.

In recent reports from London it has been suggested that nitrite crumb is likely to be superseded by preserved latex as the most promising form of rubber for this purpose. Latex, it is stated, can be more easily incorporated than crumb. The experiments have not proceeded far enough, however, to establish the superiority of one form or the other from the point view of large scale service trials. The industrial future of nitrite crumb is therefore still problematical. In order to be prepared for a commercial demand, however, attention was given to the production of nitrite crumb in large quantities.

The operations of breaking down the coagulum and of removing the excess water from the washed crumb were originally performed by laborious hand methods. Two machines have now been purchased to do this work. One is a high-speed electrically driven stirrer for converting the coagulum into a loose wet crumb and the other a centrifugal hydro-extractor in which the crumb is washed and filtered. The preparation of six tons of the material provided an opportunity of arriving at the best conditions for working with these machines and it is now considered that the process has been placed on a technically sound basis. It is convenient to consider the three main stages of the process in the light of the improvements effected by the introduction of these mechanical units.

(1) **Break-Down of the coagulum.**—Formerly, when the spongy coagulum was broken down by hand, one labourer was able to deal with 100 lbs. of rubber per hour. The same operation, it was found, could be performed by the mechanical stirrer at a rate of at least 500 lbs. per hour. Perhaps a more important advantage of the mechanical method, was that the coagulum was more completely broken down. Evidence of this was the appearance of the wet crumb and the increased rate at which the washed cake could be disintegrated. The output of the disintegrator when dealing with hand-worked crumb varied over a wide range but the average figure taken over a period of several weeks was 100 lbs. of rubber per hour. With the adoption of the mechanical method this output increased to about 160 lbs. per hour.

The mechanical stirrer was found to be capable of breaking down nitrite coagulum which had been coagulated with sulphuric acid. It has been observed repeatedly that nitrite crumb prepared with sulphuric acid as coagulant is more readily soluble in hydrocarbon solvents than the formic acid coagulated material. Sulphuric acid crumb has not hitherto been produced in quantity because of the difficulty of breaking down the coagulum by hand. No such difficulty was encountered when the coagulum was subjected to the action of the high-speed stirrer. An advantage possessed

by sulphuric acid crumb apart from its greater solubility is the saving in cost resulting from the use of the cheaper coagulant.

(2) **Washing and Filtering the Wet Crumb.**—The next stage in the process is the separation of the wet crumb from the bulk of the water phase. After draining for a few minutes on muslin the material is put into the hydro-extractor and centrifuged at a speed of 600 r.p.m. for 4 minutes during which time it is sprayed with water. The washing is then stopped and the centrifuging continued for a further 2 minutes to reduce the moisture content to about 35 per cent. When removed from the machine the charge is in the form of a cake which can be easily re-disintegrated into a crumb. It was found that with the hand-broken crumb the toughness of this cake and therefore the rate at which it disintegrated was very variable. In a series of 19 trials the speed of disintegration varied from 68 to 140 lbs. of rubber per hour. The same series of observations showed that the ease of disintegration did not depend, as was originally thought, on the moisture content of the cake but on the efficiency with which the coagulum was broken down before it reached the extractor. The increased rate of disintegration obtained with crumb that had been efficiently broken down with the mechanical stirrer has already been referred to above.

A test was developed for estimating the completeness of the washing operation. The disintegrated wet crumb (40 gms.) was shaken for five minutes at room temperature with 100 cc. of distilled water and filtered. Nitrous acid in the filtrate was then estimated colorimetrically by the method of Griess. The filtrate from well-washed crumb was found to contain 1.5 to 2 mgm. of nitrous acid per 100 gms. of wet crumb. This figure was adopted as a criterion of efficient washing.

(3) **Drying the Crumb.**—It was found that the drying of the material could be completed in less than two days at a temperature of 95°F. A consignment of crumb dried at this temperature was reported to show no abnormal tendency to mass during transit.

(b) **Stearate Crumb.**—The crumb prepared by the process described in B.P. 410,875 (Rubber Growers' Association and G. Martin) was examined in some detail as a starting material for the preparation of a softened form of rubber.

The softening achieved by the normal mastication process is now recognized to be mainly due to oxidation and this knowledge has led to the development of a soft form of rubber (marketed as "Softened Rubber") which is made by heating rubber in air (B.P. 368,902).

It was observed that stearate crumb softened very rapidly when heated at a temperature not exceeding 100°C. The rate of softening is illustrated by the following figures which show the change in the D_{90} figure (a measure of plasticity) when the rubber was heated at 100°:—

Crumb.	Time of heating.			
	Unheated.	1 hour.	2 hours.	4 hours.
B 2	1.54	0.97	0.56	0.35

From a large number of experiments it was concluded that:—

- (1) The subdivision of the rubber is mainly responsible for the rapid softening.
- (2) The presence of sodium bisulphite in the rubber retards softening.
- (3) Soaking in ammonia promotes softening.

A sample of stearate crumb containing no bisulphite was reduced to a semi-liquid state after 4 hours at 100°. It is interesting to note that with lace crepe the D_{30} figure was almost unchanged by the same treatment and in several cases heating in air actually increased the hardness of the lace rubber.

Larger quantities of softened crumb were prepared by heating in air at 100° in a Passburg drier. The D_{30} figure of the material taken for the test was 0.59 which is approximately the same as that of the "Softened Rubber" of commerce. In comparison with the latter, however, the manipulative properties of the softened crumb were disappointing. The time required for mastication was 60 to 70 per cent. of the time required for the mastication of a typical sample of blanket crepe; "Softened Rubber" required no mastication at all. A further quantity of crumb was softened to a D_{30} figure of 0.24 corresponding to a plasticity considerably greater than that of "Softened Rubber". Even so, the latter was rather more easily masticated than the softened crumb.

The fact that processing was not markedly facilitated by treating rubber in the way described indicates (1) that the type of softening obtained differs fundamentally from that of "Softened Rubber" and (2) that the D_{30} value does not give all the information required for an assessment of the manipulative qualities of a given sample of rubber. The D_{30} value may justifiably be taken as a measure of plasticity but it affords no direct indication of the elasticity of the rubber.

To be of practical interest a softened rubber (1) must be comparatively inelastic *i.e.*, "dead" and (2) it must possess little or no tendency to "recover" on keeping. From the mastication tests referred to it may be inferred that in the first respect softened crumb is unsatisfactory. As regards the second condition the following figures, which are typical of many, show that there is a slight and probably unimportant secular loss of plasticity:—

Days after Preparation	0	35	80	180
D_{30}	0.24	0.27	0.28	0.29

The results of tensile strength and ageing tests on the material may be summarised as follows:—

- (1) There was no marked difference between the tensile strength of pure mixings made with softened crumb and with average crepe.

- (2) Softened crumb gave lower intermediate modulus figures.
- (3) The ageing of the softened crumb was slightly inferior to the ageing of average crepe.

The conclusion to be drawn from this work is that the process of heating stearate crumb at a low temperature shows little promise of yielding a soft form of rubber that would be commercially acceptable.

(c) **Rubber Crumb (B.P. 449,255).**—This type of crumb is made commercially from preserved latex by flocculating with zinc chloride in the presence of casein. A small quantity of the material was made in the laboratory from ammonia preserved latex and further trials are being planned with the object of studying the possibilities of applying the same process to fresh latex.

Latex Shipment.—An ammoniating tank of what is considered to be an improved design was constructed and installed at Dartonfield. The inside of the tank was finished with a sprayed coat of stainless steel, but it was found that this did not provide sufficient protection against rust and the plant was dismantled and returned to the suppliers for a fresh application of stainless steel.

Meanwhile the old equipment was re-installed and a shipment of 500 gallons of latex was made in October.

Vulcanised Latex.—Following a suggestion from London that latex should be shipped from the East in the vulcanised condition, a preliminary series of samples was prepared by allowing freshly ammoniated latex to stand in contact with dispersed vulcanising chemicals at the ordinary temperature of the factory for periods up to 10 days. Before shipment the latex was separated from the solid ingredients by settling.

On arrival in England all the samples were found to be overcured but otherwise in excellent condition. In a further set of trials, therefore, the accelerator proportions were substantially reduced and the vulcanisation periods were made shorter. At the time of writing no report on this series has been received.

Softened Rubber.—A patented method (B.P. 368,902) which is in commercial use for making a soft type of rubber has been mentioned above under "Stearate Crumb". The original patent contemplated the softening of manufactured sheet or crepe but the process has lately been developed in Java to include wet rolled coagulum as a starting material. It is claimed that in this way the processing costs can be very much reduced. It is recognised that there would be a large demand for a softened rubber with good vulcanising and ageing properties provided the price was the same as or little more than that of crepe or sheet. A set of samples representative of the Java experiments was therefore examined with interest.

The manipulative and vulcanising characteristics of the softened rubber and the quality of the vulcanised test compounds, as judged by tensile

figures, were very good. It is unfortunate that there was insufficient material for ageing tests and that no unsoftened samples were sent from the same estate for comparison.

Developments in the production of this type of rubber are being watched with interest.

Manufactured Goods.—Numerous requests were received during the year from local scientific institutions and laboratories for rubber tubing. The Board agreed that a limited quantity of tubing should be supplied and a scale of charges was fixed. By the end of the year about 1,100 feet of tubing of various sizes had been sold.

RUBBER PAINTS.

(a) **Melted Rubber Paint.**—Paints made from melted rubber in a manner substantially the same as that described by the Director in the Report for 1935 were used for painting the iron roofs of most of the minor buildings at Dartonfield. After eight months' service the condition of most of the roofs was judged to be fairly satisfactory. The composition of a red protective paint which gave good results was:—

Scrap rubber	...	12	parts	by	weight
Raw linseed oil	...	9	"	"	"
Red oxide powder	...	16	"	"	"
Cobalt linoleate	...	$\frac{2}{3}$	"	"	"
Thinner	...	8	"	"	"

The cost of materials for this paint was slightly under Rs. 3 per gallon. The service trials confirm the opinion drawn from the results of laboratory scale experiments that this type of paint could be made economically on estates for rough outside work.

(b) **Oxidised Rubber Paints.**—Another way of using rubber in paint is described in a patent of H. P. Stevens (B.P. 407,038). In this method the rubber is added in the form of a 50 per cent. solution of milled oxidised rubber in white spirit. The oxidation is accelerated by the addition of an oxidation catalyst to the rubber during the milling operation.

It has been claimed that paints which contain a proportion of rubber have particularly good flowing and non-settling properties. This was fully confirmed by a series of trials which were specifically designed to test the claim. A straight linseed oil paint which could not be applied without brush marks was greatly improved when as little as 15 per cent. of the oil was replaced by the oxidised rubber solution.

A large number of paints were made up and panels were exposed for six months to test their weather-ageing resistance. The results at the time of writing indicate that excellent ageing properties are obtainable even with fairly large proportions of rubber. As an example of a suitable composition the following formula may be quoted:—

Boiled linseed oil	...	4	parts	by	weight
50 per cent. oxidised rubber solution	...	8	"	"	"
Red oxide powder	...	20	"	"	"
Cobalt linoleate	...	$\frac{1}{4}$	"	"	"
White spirit	...	3	"	"	"

From the evidence of these small scale experiments there were indications that the oxidised rubber paints were more resistant to tropical ageing than paints containing melted rubber. The conclusion was reached that these oxidised rubber paints were sufficiently promising to justify further investigation on a larger scale. One of the main problems was to devise an economic method of preparing the oxidised rubber solution and work on this subject was started at the end of the year.

Road Surfacing.—In the Director's Report for 1935 mention was made of some trials on the application of scrap rubber to roads. It was concluded that if scrap could be regarded as a waste product it provided an economical surface for estate roads. The method of working was to melt the scrap in a rice boiler, apply it hot to the road and cover it with sand or sifted earth.

The chief difficulties were (1) the slow rate of hardening of the rubber road surface and (2) the non-flowing property of the cold melted rubber. With regard to (2) it was found that the viscosity of the melted scrap was strongly influenced by the temperature and time of heating. If an excessive amount of rubber was distilled off, the residue set nearly solid on cooling.

The usefulness of melted rubber for road surfacing could be greatly increased if means could be found for accelerating the hardening process.

Portions of one of the roads at Dartonfield were surfaced with melted scrap during the year. The rubber was laid while hot and then covered with sand. After about 2 months the surface was hard enough to carry light motor traffic without showing wheel marks but was still insufficiently hard for lorry traffic and ironshod carts.

In an attempt to evolve a method of laying melted scrap without heating it some trials were made with aqueous emulsions. The preparation of the melted rubber emulsions presented some difficulty at first on account of the tendency to form "water in rubber" rather than "rubber in water" dispersions. A method was eventually found of producing stable rubber in water emulsions of melted scrap containing up to 85 per cent. of solids. It was considered that these emulsions held possibilities as road surfacing materials for the following reasons: (1) they were fluid in the cold, (2) they could be easily mixed with vulcanising ingredients if necessary, (3) the rubber was in a suitable form for mixing *e.g.*, with bitumen emulsions and (4) they appeared to open up possibilities in the direction of rubber-cement compositions. Pressure of other work prevented the

further investigation of this subject; it is questionable, moreover, whether the emulsions could be produced at a sufficiently low cost to be of practical interest.

Latex Sieves.—Attention was drawn in the Research Scheme *Quarterly Circular* for December, 1935, to the risk of contamination of raw rubber through the use of brass gauze for straining latex. It was recommended that estates should cease to use brass sieves and should adopt one of the alternative materials which were discussed.

It has now been confirmed that stainless steel, nickel and monel metal gauzes may all be safely used for straining field latex. The only disadvantage of these materials is that they are somewhat more expensive than brass. In order to determine their relative wearing qualities, stainless steel, monel metal and brass strainers were used alternately for routine factory work over a period of 21 months. It is still too early to say what the useful life of the steel and monel metal gauzes (30, 40 and 60 mesh) is likely to be as these materials are still in good condition, but the brass gauzes, (30 and 40 mesh) failed and were discarded after 146 days' use. Thus, although the initial cost of monel metal gauze is a little more than twice that of brass it should be borne in mind that this extra expenditure may be partially and perhaps entirely offset by the better wearing properties of the monel metal.

Local China Clay.—In the Report for 1935 it was stated that a sample of "Kaolin" submitted by the Government Mineralogist was examined and found to be of no interest as a rubber filler. Another sample of Koalin of local origin was obtained during the year and examined in the same way. The conclusion reached was that although the local clay did not show promise of being equal in its compounding properties to a good reinforcing clay it would be worth further investigation in the event of the establishment of a local manufacturing industry.

Formic Acid.—During 1936 several instances were brought to the notice of the Research Scheme of formic acid being deficient in coagulating power. In order to find out whether this was due to a falling off in the strength of the imported acid it was thought desirable to obtain and examine samples from a number of estates suppliers. It is satisfactory to note that the strength of each sample approximated closely to the declared figure:—

Sample No.	Strength		S.G. 28°
	Stated	Found	
1	90 per cent.	89·7 per cent.	1·199
2	85 ,,	84·9 ,,	1·191
3	90 ,,	89·3 ,,	1·199
4	90 ,,	89·1 ,,	1·198
5	90 ,,	89·0 ,,	1·98
6	90 ,,	89·6 ,,	1·200
7	90 ,,	90·0 ,,	1·201

Dusting Sulphur.—Several samples of dusting sulphur which were submitted early in the year were examined for sulphur content. Some consideration was given to a suitable analytical method and it was concluded that a sufficiently close approximation to the sulphur content could be obtained by estimating moisture and ash and regarding the remainder as sulphur.

Meteorological Observations.—The weather records at Dartonfield were again kept by the Chemical Department. The summary for the year 1936 is as follows:—

Rainfall	...	168.30 inches
Highest monthly rainfall	...	49.24 ,, (May)
Highest daily rainfall	...	12.00 ,, (May 13th)
Highest shade temperature (day)	...	92.8°F (Feb. 24th) (Jan. 19th)
Lowest shade temperature (night)		64.8°F (Dec. 30th)
Number of rainy days	...	225

Correspondence.—In November when the headquarters of the Scheme became centralised at Dartonfield all correspondence was handed over to the Director. Prior to this, correspondence was dealt with on the following subjects: analysis of dusting sulphur; local china clay; termite resistance of rubber products; bleaching coir; rubber pigments; manufacturing machinery; latex preservation; patents; latex strainers; smokehouse design; defects in smoked sheet; coagulating tanks; crepe mills; utilisation of scrap; boiled crepe; protective composition for pruning cuts; vulcanised crepe; plywood adhesives; rubber paints; analytical methods for latex; coir waste; sheet coagulation; rubber goods from latex; shipment of latex; manufacture of erasers, rubber mats, flooring, tubing; vulcanised latex; softened rubber; relative strength of coagulants; creaming agents; colour of crepe; lead contamination of latex; premature coagulation; tyre re-treading; accelerators; rubber powder manufacture.

PUBLICATIONS.

The following articles were published in the *The Quarterly Circular* for April, 1936:—

“Coir as a Constituent of Rubber Flooring Materials”.

“Latex Shipment”.

A review of “Rubber Latex” by H. P. Stevens was prepared for publication in *The Tropical Agriculturist*.

Leave—was taken as follows: Vacation leave *nil*; Sick leave 6 days; Casual leave 6 days; Leave for military duties 7 days.

M. W. PHILPOTT,
Assistant Chemist.

Research Laboratories,
Dartonfield, Agalawatta,
19th January, 1937.

REPORT OF BOTANIST AND MYCOLOGIST FOR 1936.

The writer assumed duties as Acting Director during Mr. T. E. H. O'Brien's absence on furlough from the 15th February to the 21st October. During this period his time was mainly occupied in administrative duties, supervision of the large building programme at Dartonfield and advisory work, and there was little opportunity for the furtherance of research.

From the 29th October to the 23rd December the writer was absent from Ceylon on a tour of inspection of Rubber estates and Research Stations in Malaya and Netherlands Indies. During this time the laboratories were moved from Culloden to Dartonfield.

Mr. C. A. de Silva, Assistant Botanist, was mainly occupied in the supervision of the field experiments at Dartonfield and Nivitigalakele and submits a separate report.

As in previous years the progress of work is recorded under the two headings: Mycological and Botanical.

I. MYCOLOGICAL WORK.

Oidium and Phytophthora Leaf Diseases.

It is convenient to consider these two leaf diseases under the same heading as the incidence of the one is closely related to the control of the other.

1. General.

Owing to the writer's additional administrative duties he was unable to undertake the usual extensive circuits during the refoliation period, and observations on the incidence of Oidium were mainly confined to the Kalutara district. Reports, however, indicated that the conditions in Kalutara were similar to those in most of the other low-country districts.

Except at elevations of about 2,000 ft. the disease caused far less damage than in any recent year. The winter was more regular than usual, and the great majority of trees developed their new foliage during hot, dry weather which was wholly inimical to the activities of the fungus. The absence of the usual cool nights in February and early March was particularly noticeable. A change of weather occurred in the middle of March, the cooler and wetter weather resulting in severe infection of the later wintering trees on estates which had not dusted or had finished the treatment too early. In most low-country localities the infected trees amounted to a very small proportion of the whole and the general appearance of the foliage was very satisfactory.

In the Kalutara and Kelani Valley districts sulphur dusting was carried out over large blocks of contiguous estates, and it was not easy to know to what extent the healthy foliage was due to weather conditions and to what extent to the prophylactic treatment. Although in some cases a contrast between dusted and neighbouring undusted areas was evident, the benefit derived from the treatment was certainly less marked than in an average year. It was a curious twist of fortune that the first year in which sulphur dusting was undertaken on a really extensive scale should coincide with a season in which the incidence of the disease was so mild, but the excellent appearance of the foliage by contrast with previous years served to show up the damage for which *Oidium* has been responsible since 1925.

In the course of a circuit of mid-country estates towards the end of February the writer saw various instances where the contrast between dusted and undusted areas at high elevations was very striking.

In the Annual Report for 1935 the occurrence was recorded of rather extensive leaf and fall due to *Phytophthora palmivora* in area in which sulphur dusting had been carried out, and it was explained that this was due to the profusion of pods consequent on the protection of the flower from *Oidium* attack, the pods serving as centres of infection for the former fungus. The same phenomenon was observed on a more extensive scale during the wet weather in June and July, 1936. As mentioned above, the incidence of *Oidium* during the 1936 refoliation season was exceptionally light, with the consequence that set of seed was unrestricted. The wet weather experienced during the South West monsoon was favourable for the formation, dissemination and germination of *Phytophthora* zoospores, and since there was a profusion of pods to serve as breeding grounds a severe attack of *Phytophthora* pod and leaf disease occurred. This was not entirely restricted to areas which had been sulphur dusted, and even untreated estates suffered considerable damage in certain localities. It was estimated that most estates in Kalutara lost between 25 per cent. and 50 per cent. of their leaves, and had the wet weather continued into August the damage would doubtless have been greater. In view of this experience the desirability of continuing the sulphur dusting treatment in the wet low-country districts needs careful consideration.

At this stage it would be well to summarise the lessons to be learned from the experience of the last three years:—

1. At mid-country elevations *Oidium* if left uncontrolled, causes serious defoliation in all but exceptional seasons. Most of the damage can be prevented by sulphur dusting, and the danger of thereby enhancing the possibilities of a bad attack of *Phytophthora* later in the year does not normally arise.
2. The incidence of *Oidium* in the wetter low-country districts is largely dependent on weather conditions, low temperatures and high humidity favouring the activities of the fungus. In 1934 the defoliation was unusually severe, and it cannot be doubted that in such circumstances

sulphur dusting is essential if the foliage of the trees is to function normally during the year. In 1936 very hot, dry weather was experienced, with the result that infection was almost negligible except on late wintering trees.

3. Although there are no critical experimental data to support the contention, it can hardly be doubted that *Oidium* has been partly responsible for the decreased rate of bark renewal which has become increasingly evident on most old estates in recent years. Judged from this point of view alone, therefore, any effective and reasonably inexpensive method of control merits careful consideration. Sulphur dusting operations carried out over large acreages have demonstrated that abnormal leaf fall can be almost entirely prevented in the low-country at a cost of about Rs. 3 per acre per annum.

4. Control of *Oidium* results in a heavy set of seed if the weather conditions are favourable. The resultant pods provide a medium for the multiplication and spread of *Phytophthora* if continued rains prevail during the South West monsoon. Control of the one fungus is therefore liable to lead to increased danger from the other.

5. The recommendation made for 1936 was to apply small quantities of sulphur with a view to obtaining only partial control of *Oidium*, the underlying idea being to permit the fungus to attack the highly susceptible flowers (thus preventing a heavy set of seed) while guarding the young leaves from serious damage. Unfortunately the incidence of *Oidium* was so light that no evidence as to the effectiveness of this compromise was forthcoming, and most estates, moreover, started their dusting rounds unnecessarily early so that the fungus was allowed no chance to develop. Even undusted properties bore a heavy crop of seed and, in some instances, suffered severe defoliation from *Phytophthora*.

Since it is impossible to predict the weather conditions — and thus the intensity of *Oidium* attack — during the refoliation season, the recommendation now made for low-country districts is that estates which normally experience appreciable leaf fall should possess the necessary equipment and sulphur to cope with a bad attack, but that no hard and fast programme should be laid down in advance. The first application should not be made until the earliest signs of crinkling of the young leaf are evident, and subsequent procedure must be dependent on the course of refoliation and the weather conditions obtaining. In this way the estate is safeguarded against severe defoliation, and it is believed that if the superintendent uses his sulphur with discretion the danger of a subsequent attack of *Phytophthora* should be greatly reduced. Any sulphur not used can be kept until the following year.

2. *Experimental.*

The only experimental work undertaken during 1936 in connection with the control of these two leaf diseases was a series of small scale dusting experiments carried out by the Assistant Botanist at Nivitigalakele. It

appeared possible that the heavy set of seed resulting from the protection of the flowers against *Oidium* infection in sulphur dusted areas might be prevented by mixing some substance with the sulphur which would injure the delicate blossom tissues without causing any appreciable damage to the young leaves. A series of sulphur samples containing various proportions of copper compounds was prepared, but the results were entirely negative. These tests will be repeated with improved methods of technique.

3. *Demonstrational.*

In 1935 the Board appointed a Committee to report on the incidence of *Oidium* and submit proposals for control measures. The Committee gave special consideration to the case of small estates and holdings, whose proprietors would not normally be able to purchase and operate sulphur dusting machines and on which treatment, therefore, could only be undertaken by means of a scheme organised under official auspices. As the outcome of the deliberations at a joint meeting of this Committee and the Executive Committee for Agriculture and Lands, a scheme of sulphur dusting an area of about 1,000 acres of small estates and holdings in the Central Province was carried out during the 1936 refoliation season. The main objects of the scheme were to determine (1) the type and cost of the organisation required in the event of compulsory measures being deemed necessary in certain localities in future years; and (2) the extent to which owners of such properties would be prepared to co-operate on a contributory basis. The work was in the charge of Mr. W. I. Pieris, Small-Holdings Propaganda Officer, who gives fuller details in his report.

The following summary of the results and conclusions is quoted from a memorandum prepared for the Board's consideration:—

1. *Oidium* is sufficiently severe on most small mid-country properties in the Central Agricultural Division to warrant the application of control measures, though in certain instances the trees are in such a bad condition from other causes that the value of sulphur dusting is doubtful. The writer is in general agreement with these views, though it may be added that the incidence of the disease in the real small-holdings is usually less than on neighbouring estates.

2. The sulphur dusting treatment, though not achieving complete control, was undoubtedly of considerable benefit to the foliage. This appears to have been appreciated by the owners of both estates and holdings.

3. A scheme of this nature is entirely practicable provided the necessary staff and funds are available, but it was found that owing to variation in the time of wintering in various districts, and irregularity of the winter in certain localities, the work was spread over a longer period than had been anticipated. The area which can be dealt with by one machine in the charge of a supervisor varies considerably with the distribution of the holdings, but 200-300 acres is probably an average figure working to an interval of 7 days between successive applications.

4. The inclusive cost of a more comprehensive undertaking would be about Rs. 10 per acre per annum. This figure is considerably higher than the normal cost of estate dusting owing to the high supervisory and transport charges.

5. The real small-holder *i.e.*, the owner of a land of less than 10 acres, while willing to allow his trees to be treated, is not, nor, in Mr. Pieris' opinion, will ever be, prepared to contribute anything to the cost. Likewise, the response from the owner of the small estate of about 10-30 acres was disappointing. Estates up to 100 acres mostly belong to the wealthier and more educated classes, and considerable interest in the treatment was evinced by this class of proprietor. There is likely to be a considerable demand for the dusting of these larger small estates on a contributory basis.

A Bulletin, summarising the results of recent investigations and including the full report on the 1936 dusting scheme, was prepared for publication and submission to Government.

II. BOTANICAL WORK.

The Improvement of Planting Material.

A. Budgrafting.

1. *Budding on Old Stocks.*

In view of the interest shown in the practicability of budding old stocks, an attempt was made on Dartonfield to budgraft 58 trees planted in 1911. The trees were generously manured in May and tapping stopped. In August four buds were applied to each tree, two on virgin bark and two on well matured renewed bark. Of the 58 trees the bark could be peeled on 43, but at the second examination only three trees bore one or more healthy buds. This result gives confirmatory evidence of the fact that although it is not impossible to bud fully mature trees the poor success renders the method commercially impracticable. Even were the operation more successful it would not commend itself in preference to replanting.

2. *Studies on Clones.*

(a) *Ceylon Clones.*—Test-tapping of Ceylon clones has been continued at Nivitigalakele and on various estates co-operating with the Scheme, the rubber being sent to these laboratories for weighing. The results for 1935 from the more interesting clones were published in *The Quarterly Circular*. 41 new clones were brought into tapping at Nivitigalakele in April, and some of these show exceptional promise.

(b) *Imported Clones.*—Throughout the year records from the test-tapping of small groups of trees of many of the well known imported clones were received from estates. The figures for 1935 were published in a paper which will form the first of an annual series. It is impossible

to summarise the figures shortly, but it may be said that in general the yields conform to the early results obtained in the countries of origin.

Table I gives girth measurements of a number of imported clones at the Iriyagama Division of the Experiment Station, Peradeniya, and is reproduced by courtesy of the Department of Agriculture. The buddings were planted as budded stumps in October, 1929, and the seedlings as basket plants at the same time. The figures are means of 60 trees planted in five randomised blocks, later supplies being excluded.

TABLE I

Clone	Girth at 3 ft. in			Increase 1935—36
	August 1934	September 1935	September 1936	
Tjirandji 1	14.30 ins.	17.90 ins.	21.25 ins.	3.35 ins.
Tjirandji 16	13.26 "	16.31 "	19.72 "	3.41 "
A. V. R. O. S. 49	12.60 "	15.54 "	18.99 "	3.45 "
A. V. R. O. S. 50	11.66 "	14.59 "	18.11 "	3.52 "
Heneratgoda 2	11.33 "	14.12 "	17.78 "	3.66 "
Tjirandji 8	11.68 "	14.24 "	17.30 "	3.06 "
Bodjong Datar 5	11.39 "	14.42 "	17.17 "	2.75 "
Sungei Reko 9	11.55 "	13.98 "	16.97 "	2.99 "
Seedlings	13.55 "	17.02 "	21.33 "	4.31 "

The position of the various clones in the list is the same as in 1935 except that Bodjong Datar 5 and Heneratgoda 2 have changed places. The girth increments during the period September, 1935, to September, 1936, are larger than in previous years, doubtless on account of a fertiliser application made late in 1935. Tapping in this block will be commenced in 1937.

3. Distribution of Material

Numerous applications were received for the budwood and budded stumps that will be available for sale from the nurseries at Nivitigalakele in 1937. The demand for stumps exceeded the anticipated supply, and allocations were made on a *pro rata* basis, preference being given to the smaller applications. A further nursery of about 2 acres was opened for supplying stumps in 1938, but owing to the fact that the land was only obtained from Government towards the end of the seed season it was unfortunately only possible to plant a small proportion of the area.

B. Selection and Breeding.

There is no further progress to report along these lines, except that clones have been established from most of the individual Prang Besar illegitimate clonal seedlings planted in the Pinnagoda clearing, at Nivitigalakele.

Problems Connected With Mature Areas.

A. Tapping.

The experiments started on two estates in 1933 to compare the double three A.B.C. system with alternate day tapping on a single half spiral cut have been continued, but it has been impossible to summarise the results for presentation in this report owing to the writer's absence during the last two months of the year and his departure on furlough early in 1937.

The Assistant Botanist gives details of the tapping experiment which has been commenced on Dartonfield. A preliminary uniformity trial which will last a year was started in April, all plots being tapped on a half spiral on alternate days.

B. Manuring.

The manuring of old Rubber has received renewed attention by many proprietors and companies and the number of enquiries received on this subject shows a further increase.

The preliminary year's uniformity trial in connection with the manuring experiment on mature trees on Dartonfield was completed at the end of the year, and the first application of fertilisers was made in December. The treatments are as follows:—

1. Control.—No Manure.
2. N.—Nitrogen only, as 1·90 lb. of sulphate of ammonia per tree.
3. NP.—Nitrogen as above + phosphate as 1·32 lb. of Safaga phosphate per tree.
4. NK.—Nitrogen as above + potash as ·77 lb. of muriate of potash per tree.
5. NPK.—Quantities as above.

The quantities of the various fertilisers were calculated so as to give 40 lbs. of each nutrient per 100 trees. The applications will be made annually.

Each of the four blocks (replications) is divided into two sub-blocks, in one of which the manure is to be broadcast and in the other to be forked in together with *Pueraria* loppings. A ground cover of this species is in process of establishment throughout the experimental plots.

For fuller details of the layout the reader is referred to a paper by the Assistant Botanist published in *The Combined 2nd and 3rd Quarterly Circulars* for 1936.

C. Cover Crops.

A block of 20 acres on Dartonfield has been set aside for a trial of natural covers under mature Rubber. All weeding was stopped as from the 1st January, 1936, the intention being in the first place to study the flora that establishes itself naturally without any cultural assistance. After

six months the Assistant Botanist recorded the occurrence of about 30 species, the predominant varieties being:—

Dolichos Hosei (Vigna) (introduced some years ago).

Schizaea digitata (a common fern) and

Grasses.

After twelve months there was little change except that in certain areas the grasses had become rather thick and had to be thinned out. At present the block is simply rather more "weedy" than the rest of the estate, and it would appear that the tempo of the process is extremely slow under the local conditions. Attempts will be made in 1937 to propagate the more desirable types.

Similar studies are being carried out by a number of estates.

D. Replanting.

The figures given later in this report for the number of enquiries on matters connected with replanting and budding reflect the great interest at present being shown in this subject. A large number of estates are undertaking replanting programmes, often on an extensive scale, and the advisory services of the Scheme are much in demand. The practical experience gained on Dartonfield is proving of great value in replying to enquiries on costs and methods of procedure.

The progress of work in the experimental replanted clearings at Dartonfield is summarised below:—

1934 Clearing ($7\frac{1}{2}$ Acres).—This area was replanted with budded stumps in June 1934, the purpose being to compare: (1) methods of disposal of the old timber; (2) species of ground cover crops; and (3) methods of controlling the ground cover. The girth of every tree (including later supplies) was measured in September *i.e.*, exactly two years after cutting back the stock to force the bud to sprout. The figures for the various treatments are given in Table II:—

TABLE II

Treatment	Mean girth at 3 ft. from union
Leaving large timber lying unburnt	5.38 ins.
Burning all timber above ground	5.19 "
Ditto, but also removing and burning all the larger lateral roots	5.22 "
<i>Calopogonium mucunoides</i>	5.51 "
<i>Dolichos Hosei</i> (Vigna)	5.43 "
<i>Centrosema pubescens</i>	5.16 "
<i>Pueraria phaseoloides</i>	4.95 "
Keeping platforms clear of cover	5.30 "
Keeping only a 6 ft. circle clean round each plant	5.22 "

A statistical analysis shows that none of these differences is significant. The differences in growth under the various covers are possibly indicative, but the number of replications of this series of comparisons is insufficient to reveal any but rather large differences. The comparison between the methods of controlling the ground covers is, on the other hand, a fairly accurate one as there are 36 replications, and it is somewhat surprising to find that as yet the ground cover has apparently exercised no retarding effect on the growth of the young buddings. This may possibly be explained by the fact that the plants have been generously manured so that there is plenty of food for both the covers and the Rubber plants. It should also be noted that the cover is cleared from the platform twice a year when the fertilisers are applied.

Table III gives an indication of the relative rates of growth of the three clones with which this field is planted. These figures do not include supplies and the comparison is not replicated.

TABLE III

Clone	Height in		Girth at 3 ft. from union in Sept., 1936
	October, 1935	September, 1936	
Glenshiel 1	8.96 ft.	15.83 ft.	5.07 ins.
A. V. R. O. S. 256	9.40 „	17.40 „	5.83 „
Prang Besar 25*	9.08 „	16.94 „	5.15 „
Mean	9.14	16.72	5.35 „

* This clone was formerly supposed to be Prang Besar 186, the original importation having been incorrectly labelled.

1935 Clearing (13½ Acres).—This field was planted with budded stumps in June, 1935, the main experimental object being to determine the fertiliser requirements of young budgrafts on replanted land. The first application of manures was made in January, 1936, and the second in July. During the latter month the height of every plant was measured, but the results showed no significant treatment differences. The lack of response to any nutrient or combination of nutrients may probably be attributed to two facts:—

1. The holes were uniformly filled with top soil, which appeared to be of good quality in this particular area.
2. The early growth from a transplanted stump is more a function of the reserves contained in that stump than of the food absorbed by the root system.

It is unfortunately necessary to report that a "rogue" was found in the block that was supposed to have been planted uniformly with Tjirandji 1.

All plots in this block had to be replanted in October, 1936, and it will be impossible to include this replication in the experiment until 1938.

1936 Clearing (10 Acres).—The following series of comparisons is being made in this area:—

Methods of Opening.

1. Planting on contour platforms.
2. Planting in contour trenches.
3. Contour planting, with level pitted drains between the contours.

Methods of Planting.

- (a) Planting budded stumps.
- (b) Planting stumped buddings.
- (c) Planting one basket plant and four germinated seed in each hole for subsequent budding in the field.

Manuring:—

- (x) A complete inorganic mixture.
- (y) A complete organic mixture.

No measurements have yet been made, but the growth of all forms of planting material shows promise of being uniformly good.

The details of the opening and planting are given in the Superintendent's Report, and a full account of the experimental layout was published in *The Quarterly Circular*.

EXPERIMENT STATION, NIVITIGALAKELE.

General supervision of the work at Nivitigalakele was exercised during the year, progress being recorded in detail by the Superintendent.

41 new clones were brought into test-tapping as from the 1st April, and all trees in the 1926 and 1927 clearings with a girth of 20 ins. and over at a height of 3 ft. from the union, which were not already being test-tapped, were taken into semi-commercial tapping. Individual yields from these trees are not recorded, but the latex from each clone is separately collected and measured. In all, about 2,000 trees were in tapping during the last 9 months of the year.

The growth of the budded stumps planted in the Pinnagoda clearing in 1935 was satisfactory, but the development of the seedlings in the other portion of the clearing has been somewhat disappointing, with the result that it was not possible to complete the budding programme by the end of the year. The same remarks apply to the 6½ acres budwood multiplication nursery, the budding of which will have to be completed in March-April, 1937.

III. VISIT TO MALAYA, JAVA AND SUMATRA.

As mentioned earlier in this report the writer was privileged to pay a visit to Malaya and the Netherlands Indies from the 29th October to the 23rd December. The visit was the outcome of a suggestion by the Ceylon Association in London that an officer of the Scheme should visit these countries in order to obtain first-hand information regarding the yields of budgrafted Rubber in commercial practice. While this remained the main object of the tour, the opportunity was also taken of studying the work of the various Research Stations and the agricultural conditions and practices in the three countries. The tour proved extremely interesting and instructive and a full report was prepared for submission to the Board before the writer's departure on leave early in 1937.

IV. ADVISORY WORK, CORRESPONDENCE, ETC.

1. *Estate Visits*.—Owing to administrative duties it was impossible for the writer to accede to most of the requests for consultative visits. The number of visits paid were as follows, the corresponding figures for 1935 being given in brackets:—

Advisory	...	...	21	(46)
Experimental	...	...	6	(17)
Dartonfield and Nivitigalakele	...		81	(68)

2. *Specimens and Enquiries*.—The number of specimens sent for identification and report was 58 as compared with 40 for 1935.

Enquiries were received from estates and agency houses on the following subjects (figures for 1935 in brackets):—

Botanical:—

*Budding and allied subjects		222	(76)
Replanting procedure	...	163	(63)
Manuring		49	(38)
Cover crops		58	(39)
Tapping		23	(30)
Miscellaneous planting matters		30	(14)
		545	(260)

Mycological:—

Oidium and sulphur dusting	...	91	(165)
Other diseases		32	(24)
		123	(189)
		Total	668 (449)

* Most of these enquiries were in reference to replanting.

3. *Visitors*.—The inauguration of two specified Visitors' Days at Dartonfield every month appears to be appreciated by the planting community. The writer personally met nearly 200 visitors at Culloden, Dartonfield and Nivitigalakele.

Mr. C. E. T. Mann, Senior Botanist of the Rubber Research Institute of Malaya, stayed two weeks in Ceylon in February-March, and a programme of visits to estates in various districts was arranged for him.

4. *Correspondence*.—The total correspondence dealt with by the writer was 3,528 inward and 3,745 outward letters.

V. PUBLICATIONS.

1. Bulletin No. 53.—Oidium Leaf Disease.
2. Replanting of Rubber.—*Quarterly Circular*, Vol. 13, Part 1.
3. The Performance of Imported Clones in Ceylon.—*Quarterly Circular*, Vol. 13, Parts 2 and 3.
4. Ceylon Clones IV.—*Quarterly Circular*, Vol. 13, Parts 2 and 3.

R. K. S. MURRAY,

Botanist and Mycologist.

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Dartonfield, Agalawatta,
February 17, 1937.

REPORT OF THE ASSISTANT BOTANIST FOR 1936.

Buildings.—The botanical block was completed early in July and the writer moved into his permanent quarters in a section of the building. Attention was given at the end of the year to the equipment of the different laboratories in this block.

Field Experiments.—A full programme of work in connection with field experiments has claimed the major portion of the writer's time during the year. Uniformity trials in connection with the manuring and tapping of mature rubber have been carried out with the assistance of two experimental conductors. Measurements have been made under the writer's personal supervision of all budded Rubber plants in replanted areas opened out in 1934 and 1935 and where possible figures have been statistically developed to show the effect of differential treatment with regard to cover crops, disposal of timber, and manuring. No significant variations in growth due to the different treatments have been found up to the present. The lack of response, generally, may be attributed to the fact that the plants are still in an early stage of growth. The year under report saw the completion of a further 10 acres of replanting. This area has also been planted in a statistical layout to test out different systems of planting and opening new clearings.

Experiments in connection with sulphur dusting and "forestry methods" were initiated during the year. The progress of work in connection with the above experiments will be considered under appropriate headings.

Manuring Experiment.—The uniformity trial, which was started on 1st January, was brought to a close on 31st December, and yield records have been summarised for statistical development. Early in December manurial treatments were assigned to the different plots, and the manures were applied under the personal supervision of the writer. Details of the treatments are given in the Botanist's Report.

Tapping Experiment.—The experiment consists of 6 blocks of 11 plots each and each plot has 30 trees. All trees within a plot were painted with a distinctive colour, or combination of colours. The six blocks have been marked out in two fields over an area of approximately 22 acres. Eleven different systems of tapping corresponding to the 11 plots in each block have been divided into two sub-blocks "two day series" and "three day series" for the convenience of tapping arrangements, as follows:—

Treatments :—

1. Two day series

- (a) One half spiral cut on alternate days with a six monthly change over of tapping panel.
- (b) Same as the above but with A.B.C. (12/6) cycle of periodic rest.
- (c) Alternate half spiral cut on alternate days.
- (d) Two quarter spiral cuts in echelon on alternate days with a six monthly change over.
- (e) Double four system.
- (f) Double four system with A.B.C. (12/6) cycle of periodic rest.

2. Three day series.

- (g) One half spiral cut every three days with a six monthly change over.
- (h) Double three with no rest.
- (i) Double three with A.B. (6/6) cycle of periodic rest.
- (j) Double three with A.B.C. (12/6) cycle of periodic rest.
- (k) Double three with A.B.C. (8/4) cycle of periodic rest.

The treatments will be randomised within each sub-block and the two series will be randomised in each block. The layout of this experiment was completed in March, and a year's uniformity trial was started in the middle of April. Tapping in the uniformity trial is on the alternate day single cut system with a change over to the other panel after six months. Precautions have been taken in the field with a view to reducing tapping errors by a suitable rotation between tappers and the time of tapping individual plots.

1934 Replanted Area ($7\frac{1}{2}$ Acres).—Both height and girth measurements of the 830 trees in this area were made by the writer in the middle of September, and examined statistically. The results are discussed in the the Botanist's report.

1935 Clearing (13 Acres).—Manuring according to experimental requirements was carried out in January and July under the writer's supervision. The height of the plants was measured in July.

1936 Replanting (10 Acres).—The replanting of 10 acres which was started in September, 1935 was completed in May, 1936, except for the planting of seed at stake, which was held over till September. The statistical layout of this area was personally supervised by the writer. Details of the experimental layout and cost of opening works were published in *The Fourth Quarterly Circular* for 1936.

Forestry Methods.—A preliminary ecological survey was carried out in June in the 20-acre block set aside for the study of "forestry" cultivation. About 30 species of cover were identified during the survey.

Sulphur Dusting Experiment.—Experimental dusting of 40 individual trees was carried out during the refoliation period with a series of 7 mixtures which were being tested for the purpose of causing blossom injury. The experiment is discussed in the Botanist's Report.

Advisory Work.—Visits were made to three estates during the course of the year in connection with replanting work. In view of the fact that several estates were using budwood from old nurseries and plantations, which were supplied with foreign clones a number of years ago, the work of identifying clones attained considerable importance. After the departure of the Mycologist to Malaya, the writer took over certain sections of his advisory work.

Publications.—The following articles were published in *The Quarterly Circular* during the course of the year:—

- A. Field Experiments on Dartonfield Estate. II.—Manuring Experiment with Mature Rubber.
- B. Field Experiments on Dartonfield Estate. III.—Replanting.
- C. Field Experiments on Dartonfield Estate. IV.—Replanting.

CLEMENT. A. DE SILVA,
Assistant Botanist.

Rubber Research Scheme Laboratories,
Dartonfield, Agalawatta,
January 26, 1937.

REPORT OF THE SMALL-HOLDINGS PROPAGANDA OFFICER FOR 1936.

The writer's duties during the year may conveniently be reviewed under :—

1. Sulphur Dusting in the Central Province.
2. General Small Holdings Work.

1. SULPHUR DUSTING.

Object and Organisation.—Duties were taken up at Peradeniya on January 3rd in charge of the campaign for sulphur dusting small estates and holdings in the Central Province, launched by the Rubber Research Scheme. The object of the campaign, besides being demonstrative, was to determine the cost and type of organisation required for dusting properties of under 100 acres on an extensive scale and to ascertain to what extent small proprietors would co-operate in the scheme on a contributory basis. A grant of Rs. 20,000 for the purpose was provided by Government from the Rubber Restriction Fund.

Approximately 200 acres of Rubber, consisting of small-holdings of 1 to 10 acres and small estates of 11 to 100 acres, were selected from each of five Agricultural Instructors' Ranges most severely affected with Oidium, comprising an approximate total of 1,000 acres (actually 1,003). The ranges selected were Gampola, Katugastota, Udispattu, Rattota and Matale. In selecting estates preference was given to owners who were prepared to contribute a nominal fee of Rs. 2-50 per acre for small estates and Re. 1 per acre for holdings for the complete treatment. Dusting operations in each range were in charge of a temporarily appointed dusting supervisor working under the supervision of the writer.

Dusting.—Dusting of the selected areas in each range was commenced directly about 20 per cent. of the trees of each estate or holding had just begun to refoilate after wintering, and continued at 7 day intervals until 80 to 90 per cent. of the trees had matured their leaf. The first dusting was given on January 14th. Dusting in the Gampola and Katugastota ranges whose wintering was early and regular was commenced in January and February and completed by the end of March, while that at Udispattu, Rattota and Matale which was commenced in February and March was protracted till the 15th of May owing to late and irregular wintering. Wintering in certain areas in the 3 latter ranges was so irregular that

even after 13 dustings (normal being 6-8), a considerable portion of the trees had not refoliated. Irregular wintering appeared to be associated to some extent with fertile soil conditions and is likely to be troublesome in organised dusting work.

Dusting in each range was done with a separate dusting machine, while 2 machines were kept in reserve. The 1,003 acres dusted consisted of 67 individual estates and holdings varying from 100 acres to 1 acre in extent each. The average quantity of sulphur used per acre for the complete treatment, which varied from 5 to 13 dustings according to duration of refoliation, was 39 lbs. and the all-inclusive cost per acre Rs. 14·81. 298 acres (estates) out of the 1,003 acres were dusted on payment and the remainder free of charge. Sinhalese labour was employed throughout.

Conclusions.—The following main conclusions were drawn from the dusting campaign:—

1. Sulphur dusting in practically every estate or holding dusted was definitely beneficial in controlling *Oidium*, marked results being obtained in most cases.

2. In the localities dusted, *Oidium* infection prevailed fairly generally but appeared to vary in intensity according to different factors such as weather. In instances where the condition of trees is very poor or refoliation unduly protracted due to irregular wintering, the value of dusting is doubtful.

3. The cost of dusting an acre (complete treatment) worked out at Rs. 14·81, but the actual cost for a more comprehensive scheme would probably not exceed Rs. 10. The cost is necessarily higher than the normal cost of estate dusting owing to the high supervising and transport charges.

4. The real small-holder, *i.e.*, the owner of a land of 10 acres and less, though anxious to have his holding dusted, was on no account prepared to pay for it, and any future dusting will have to be done for him free of charge. Response from the owner of 10 to 30 acres was also disappointing. The owner of 30 to 100 acres however, who is not really a small-holder at all, was very glad to have the dusting done on a contributory basis (*i.e.*, Rs. 2·50 per acre) and a considerable demand is likely to be forthcoming from this class of owner.

Sulphur Bombs.—Two one-acre holdings out of the 1,003 acres were experimentally dusted with sulphur bombs. Sufficient bombs to make up the required quantity of sulphur for a dusting were taken and lighted (at the end of a pole) at different places in the holding so as to give it a general dusting. The results obtained showed that although on the whole not as satisfactory as machine dusting, the method is likely to be useful to owners who are not in a position to afford machine dusting, and also for dusting groups of early and late wintering trees on estates.

A full report on the dusting campaign was prepared and published as a section of Rubber Research Scheme Bulletin No. 53.

2. SMALL-HOLDINGS WORK.

On returning to headquarters at Neboda in the middle of May, work in connection with the organisation of the new Small-Holdings Department of the Rubber Research Scheme was taken in hand. Considerable progress in this direction was made during the remainder of the year, an outline of the main features of which are given below.

Staff.

(a) **Rubber Instructors.**—Upon the decision of the Board that the instruction of Rubber small-holders should be commenced in the Kalutara district with 2 Rubber Instructors stationed at Horana and Mātugama respectively, these posts were duly advertised and filled by the appointment of Messrs. H. K. Wijeyasinghe and N. T. M. L. de Silva who reported to duty on August 10th. 135 candidates applied for the 2 posts.

On appointment, these officers were given a 3 months' course of special training in rubber work, which was considered an essential preliminary to their future duties, before being allocated to their ranges. The training consisted of a course of lectures by the writer on various subjects, such as sheet making, smoking and smokehouses, budding, replanting, soil conservation and improvement, tapping, diseases, cover crops etc. with special attention of the applicability of these subjects to small-holders, followed by short courses at Nivitigalakele and Dartonfield where, among other things, they received training in budding, tapping and general field work. Their training was concluded with a written test, upon the satisfactory results of which, they were assigned to their ranges from November 16th—Mr. Wijeyasinghe to Horana and Mr. De Silva to Matugama.

(b) **Clerk and Translator.**—This officer, Mr. A. A. Silva, who is to translate literature prepared by the Small-Holdings Department into Sinhalese for publication and is also to do the writer's clerical work, was selected from 46 applicants and assumed duties on October 1st. After preliminary training in typewriting and office work, of which he had had no previous experience, he took full charge of the writer's clerical work from November 10th. The major portion of a bulletin on replanting to be issued to small-holders early in 1937, was translated by him.

Inauguration of Work in Ranges.

(a) **Co-operation with Government Departments.**—Arrangements were made through the Director for the co-operation of the Chief Headman's Department and Department of Agriculture in the future work of the Small-Holdings Department. Thereafter, on assigning the Rubber Instructors to their respective ranges on November 16th., they were officially introduced to the Mudaliyar (and through him to the Headmen), the Agricultural Instructor and other persons, such as Chairmen of Village Committees whose co-operation will be necessary in their future work.

(b) **Meetings of Small-Holders.**—In each range a meeting of Rubber small-holders was organised in December for the purpose of introducing the new Small-Holdings Department and its objects. An address in Sinhalese was delivered at each, explaining the full benefits to be derived from the Department and the manner in which it proposed to carry on its work. Both meetings proved a great success, over 600 small-holders being present at Horana and about 370 at Matugama, some of whom manifested a keen interest in the proceedings. Models of the small-holders smokehouse and smooth roller, and various grades of village sheet were displayed. The Director, the State Councillor for the district and the Mudaliyar were also present and made brief addresses.

Smokehouse etc. for Small-Holders.

(a) **Smokehouse.**—With the special object in view of producing a smokehouse for small-holders which, whilst being efficient, would cost as little as possible, an experimental smokehouse was designed and constructed on a holding close to the Laboratories. The walls were made of wattle and daub with milla posts for the four corners and the inside based on the plan of a more expensive smokehouse designed by the Research Scheme. To ensure economy the roof was made of gunny sacking nailed to a wooden frame, the idea being derived from the Malayan 4 dollar smokehouse which is made entirely of sacking. The entire structure is protected from rain by a light cadjan canopy, which extends on one side to form a useful shed for firewood etc. The smokehouse cost Rs. 15.59 excluding labour, which was provided by the owner and which every small-holder is expected to carry out himself. The house is estimated to last a minimum of 25 years (except the cadjans and sacking which will have to be replaced periodically), internally measures $5\frac{1}{2}$ by 6 by 7 ft. high, and has a capacity of 80 sheets, or 120 lbs. which would enable it to deal with the crop from a 15 acre estate. It is producing very satisfactory sheet and promises to be very useful to small owners in the future.

A vote was obtained for erecting 5 demonstration smokehouses similar to the above in each of the two Rubber Instructors' Ranges during 1937.

(b) **Smooth Roller.**—In view of the undesirable practice among poorer small-holders to smooth roll their sheet on the high road, a simple hand roller designed on lines suggested by the Assistant Chemist was made. This roller, consisting of an 18 in. length of 3 in. piping filled with cement with an iron bar passed through to serve as handles at either end, is used on a wooden board covered with aluminium sheeting, the whole costing approximately Rs. 4 to make.

(c) **Budding Knife.**—A rigid knife suitable for slicing buds off budwood and somewhat similar to one used at Malaya was designed by the writer and made by a local blacksmith for 60 cents, to supply the need of a cheaper budding knife than the imported instrument for small-holders.

(d) **Acid Testing Apparatus.**—The writer is indebted to the Assistant Chemist for supplying boxes of apparatus to the instructors for easily differentiating between acetic, formic and sulphuric acid. These will be useful in testing the acids used by small-holders as coagulants.

Marketing of Rubber.—Investigations made on marketing conditions showed that on a Colombo market price of 40 cents for sheet, honest local dealers (middlemen) usually pay about 2 cents per lb. less for average small-holders' sheet. Allowing $\frac{1}{2}$ a cent for transport and 1 cent for poor quality the dealer thus makes a nett profit of $\frac{1}{2}$ a cent per lb. The responsibility of the Small-Holdings Department towards the small-holder therefore appears to be to reduce the loss of 1 cent (sometimes more) at present sustained on poor quality by improving the quality of his sheet. In this connection it should be mentioned that a number of unscrupulous dealers do exist who reap a much larger nett profit than $\frac{1}{2}$ a cent from ignorant villagers. Dealers also purchase coupons separate from sheet even when the two come together, thus making a profit on the coupons apart from that made on the rubber. The most unfair profit however is made in buying coupons in advance, a small-holder in need of urgent cash only getting about 15 cents per lb. for his next instalment of coupons, when coupons are actually selling at 30 cents in Colombo.

Observations also show that sheet is seldom or never bought by dealers on any definite system of grading with the result that much moderately well made sheet is paid for at the same rate as poor sheet. This is unfair on the holder who takes the trouble to produce good quality sheet and a system of purchase on a grading basis will be a boon to all parties concerned. An attempt to persuade dealers to adopt such a system is intended to be made in 1937.

Samples of small-holders smoked sheet submitted to Colombo for quotation showed a difference of $\frac{1}{2}$ to 2 cents in value below standard sheet, thus manifesting considerable room for improvement in quality.

Bulletin on Replanting.—A Bulletin on the subject of replanting, which is engaging much attention among Rubber owners at present, was written in a form in which the subject applies to the small owner. After translation and printing it will be issued free to small-holders early in 1937. A number of enquiries on replanting were received from small-holders.

3. GENERAL.

Vegetative Propagation of Stocks.—21 buddings (remaining), which in June, 1934 were layered with a view to getting the vertical shoots which came up along their main stems to root by etiolation, were examined in August. Although no root formation had taken place in June, 1935, the present inspection revealed 8 out of 30 vertical shoots to have rooted. All the rooted shoots were ones that had been "wired" at the collar. The

experiment shows that it is not impossible to root buddings (as distinct from seedlings) by layering as it is sometimes supposed but the method is only likely to be of use for special experimental purposes.

Scope of Small-Holdings Department.—It was decided by the Board that the work of the Department should be confined to estates and holdings under 30 acres in extent.

Designation.—The writer's designation was changed into "Small-Holdings Propaganda Officer."

W. I. PIERIS,

Small-Holdings Propaganda Officer.

Small-Holdings Propaganda Office,
Culloden, Neboda,
January 19, 1937.

ESTATE SUPERINTENDENT'S REPORT FOR 1936.

DARTONFIELD ESTATE.

Rainfall.—Distribution of rainfall has been normal. Details of rainfall during 1936 and the preceding year appear below:—

		1936	1935
January	...	1·78 ins.	4·74 ins.
February	...	3·26 „	6·24 „
March	...	14·20 „	18·76 „
April	...	3·31 „	8·92 „
May	...	49·24 „	25·89 „
June	...	9·02 „	17·43 „
July	...	13·04 „	6·11 „
August	...	2·33 „	15·83 „
September	...	14·67 „	6·78 „
October	...	16·63 „	21·24 „
November	...	30·98 „	19·51 „
December	...	9·84 „	10·72 „
Total		168·30 ins.	162·17 ins.

Crop.—Crop has fallen short of the estimated harvest by 5,296 lbs. The decreased crop is mainly attributed to a somewhat severe attack of secondary leaf fall experienced during the South West monsoon.

Field No.		Total crop	Acreage	Yield per acre
		lbs.		lbs.
No. 1	...	19,447	30·2	643·9
No. 2	...	1,252	2·4	521·7
No. 3	...	19,533	41·9	466·2
No. 4	...	2,393	3·0	797·7
No. 6	...	32,079	62·5	513·3
Total		74,704	140·0*	533·6

* Owing to removal of trees for roads and buildings the correct tapping acreage is 130 acres.

Estimated crop 80,000 lbs. Percentage of estimate harvested —
93·38 per cent.

Tapping.—The double four system of tapping was continued unaltered, except in the area under a tapping experiment.

A manurial experiment for mature rubber and an experiment for comparing tapping systems were initiated during the year. Tapping for the first year's uniformity trial was begun in January and March. The systems employed were the double four in the case of the former and the alternate day single cut system in the latter.

Manufacture.—Manufacture was continued on similar lines to that of previous years, the production of smoked sheet and crepe being given precedence over other grades. An increased demand for nitrite crumb from the London Advisory Committee, however, has been met by a higher production of this grade. A consignment of 500 gallons of ammoniated latex was also prepared and shipped to London. A high standard of manufacture is being maintained and the grades offered for sale in the local market continue to realise top prices. The following is a detailed statement of the distribution of grades against the crop harvested:—

Grades	Lbs.	Per cent.	Total
Smoked Sheet No. 1 ...	19,744	26·43	} 26·55
„ „ No. 2 ...	86	·12	
Pale Crepe No. 1 ...	28,520	38·18	} 40·23
„ „ No. 2 ...	1,082	1·45	
„ „ No. 3 ...	451	·60	
Scrap Crepe No. 1 ...	5,836	7·81	} 11·45
„ „ No. 2 ...	2,718	3·64	
Crumb Rubber ...	13,427	17·97	} 21·77
Latex for experiments ...	924	1·24	
Ammoniated Latex ...	1,916	2·56	

Machinery.—The factory engines and machinery have worked satisfactorily. No repairs were necessary other than a few replacements to the water pump of the 9 H.P. Lister Engine. A centrifugal hydro-extractor was recently installed in connection with the manufacture of crumb rubber and has greatly simplified the manufacture of this product. The figures tabulated below show a summary of the consumption of fuels covering the periods January-June and July-December:—

	Large Engine. (Ruston Hornsby 52·57 H.P.)			Small Engine. (Lister 9 H.P.)		
	Hours worked.	Diesoline oil. Gals.	Lubric: oil. Gals.	Hours worked.	Diesoline oil. Gals.	Lubric: oil. Gals.
January-June	407	459 $\frac{3}{4}$	48 $\frac{3}{4}$	869 $\frac{1}{2}$	460 $\frac{3}{4}$	8 $\frac{3}{4}$
Average per hour		1·13	·12		·53	·01
July-December	689	764	55	927	432 $\frac{3}{4}$	25 $\frac{3}{4}$
Average per hour		1·11	·08		·46	·03

Pests and Diseases.—As a result of good weather and sulphur dusting treatment, the incidence of Oidium during refoitation has been the mildest experienced in recent years. More active development of the fungus was

observed among individual late wintering trees. Dusting operations were carried out at approximately weekly intervals, the quantity of sulphur being limited to 4 lbs. per acre per dusting. The use of sulphur bombs has proved effective in the treatment of isolated trees. The absence of any severity of the disease encouraged a profusion of pod production which led to a somewhat severe attack of *Phytophthora* later in the year. Much secondary leaf fall resulted and cases of bark rot occurred, while the effects of this attack seem to have shown up in poorer yields during the months following.

A case of *Fomes lamoensis* (Brown root disease) was detected on a tree in No. 6 Field and prompt measures of treatment taken.

Cases of Ustulina, Canker and Brown Bast, although present, have not been greater than in any recent year.

Weeding.—Selective weeding was carried out during the year. Species such as grasses, bracken, mikania and illuk are being removed; all other natural covers are being allowed to develop as a temporary measure during the development of a cover of *Pueraria* to replace the present sparse cover of vigna.

Forestry Methods.—An area of approximately 20 acres mature rubber has been set apart for the study of natural undergrowths in connection with forestry methods of cultivation.

Cultivation.—An area of 40 acres was manured as part of a regular manuring programme. Treatment consisted of the application of sulphate of ammonia at 400 lbs. per acre, envelope forked between the rows of trees. The fertiliser used at the commencement was later altered to a mixture containing 3 parts sulphate of ammonia to 1 part saphos phosphate.

Silt Pits.—Silt pits were cut in the existing drains in the manured area. The pits were 6 feet long by 18 inches deep, spaced at intervals of 6 feet in the drains.

Cover Crop.—An effort to establish *Pueraria phaseoloides* as a ground cover over the whole estate, exclusive of the "forestry" area, has met with varied success. Planting was carried out in beds 3 ft. square prepared in the spaces between the trees with due precautions taken to prevent surface feeders from gaining entrance and feeding at the expense of the cover. Three methods of propagation were tested:—

1. Marcotted cuttings.
2. Germination of seed in coconut husk.
3. Direct seed distribution.

The best results were obtained with marcotted cuttings. Seedling plants established in husk show good growth in the field, although earlier growth in the nursery was considerably retarded by the activity of snails. On

the whole these did not come up to the standard of marcotted cuttings. Seed planted direct in the field was disappointing. The growth was generally too poor to withstand any unfavourable conditions.

Unproductive Trees.—Diseased and unproductive trees were thinned out to allow for better development of the neighbouring trees. A total of 592 trees was removed.

Labour.—The labour force of Tamils has been adequate for normal estate requirements. However, some difficulty was found in obtaining the full amount of Sinhalese labour required in the later months of the year. The shortage is attributed to the demand for indigenous labour from neighbouring estates, chiefly in connection with increased replanting work. The figures enumerated below will show the labour position per month during the year:—

		Monthly total of Labour on Check-Roll		
		Tamils	Sinhalese	Total
January	...	81	48	129
February	...	79	61	140
March	...	75	48	123
April	...	74	71	145
May	...	65	68	133
June	...	66	56	122
July	...	78	70	148
August	...	75	53	128
September	...	73	76	149
October	...	76	73	149
November	...	80	62	142
December	...	82	89	171

Figures for daily out turn and daily rate of pay are as follows:—

Average daily out turn	...	...	80
Average wages per day	...	...	43.66 cents.

Cart Road, Roads and Paths.—Construction of an inspection road through the upper part of the estate which was commenced in the latter part of 1935 was not concluded until September owing to the concentration of labour on other more important works early in the year. This road which is 54 chains in length entailed considerable dynamiting and building of 28 culverts and 2 small bridges.

Branch extensions to the Director's bungalow and Botanical Laboratory are under construction.

The main outlet road through Gallawatte estate has had several improvements made in the way of widening of sharp corners and surface repairs.

Nurseries.

1934 Nursery.—According to the final experimental layout of the 1936 replanted clearing, only 50 per cent. of the plants in this nursery were required as stocks for budding. The remainder were budded from time to time with different clones to meet other requirements.

Experimental Areas.

1934 Replanted Area.—Manuring was carried out twice as in former years, with a complete fertiliser mixture. Manures were applied in slightly increased doses at the rate of 8 ounces and 1 lb. per plant in April and September respectively.

Careful attention has been given to the control of cover plants according to the experimental layout of this area.

1935 Replanted Area.—This clearing was also twice manured according to an experimental programme, in conjunction with various green manure treatments.

A number of plants in this area were affected by *Phytophthora* dieback during the South West monsoon. The diseased stems were cut back and the plants sprayed with Bordeaux mixture. Other plants, which showed early signs of the disease, were also sprayed to prevent further infection.

Owing to a mixing of clones in the Tjirandji 1 block of this area, which was traced to part of the material originally established at Nivitigalakele, it was necessary to replace all plants in the experimental plots with dormant budded stumps in order to obtain a uniform stand. This was done during the North East monsoonal rains. Genuine Tjirandji 1 plants removed from the plots were transferred to barrier rows.

The seedlings in barrier rows of Blocks 1, 2 and 4 were budded with a fair proportion of success. The stocks were cut down to 3 inches above the bud patch in cases where the bud had taken. Of the plants so treated, a number have already sprouted and are showing good and healthy growth.

1936 Replanted Area.—As a detailed description of the experimental layout as well as the general procedure of clearing and opening has already appeared in a quarterly publication, only a brief outline of the work is given here.

After a preliminary survey of the area by the Assistant Botanist in conjunction with the general layout, all subsequent operations pertaining to earthworks up to the time of planting were carried out under the writer's supervision. With the advent of the South West monsoon soon after the earthworks were completed, observations were made during heavy rains on "run-off" as well as the stability of the different systems of drainage. All three systems functioned quite satisfactorily, although a few washaways were noticed in the pitted drains and trenched areas, due

chiefly to the outlets to leader drains becoming blocked by earthslips. Nearly all the damage was confined to very steep slopes where these systems happened to fall owing to randomisation of treatments. Planting was carried out on 3 systems to meet experimental requirements. Four foreign clones have been established. The details of planting are indicated in the figures tabulated below :—

Block	Clone	Stumped buddings	Budded stumps	Seedlings	Total
1.	A.V.R.O.S. 49	136	129	113	378
2.	Prang Besar 25	84	96	106	286
3.	Sungei Reko 9	77	78	93	248
4.	Rubana 393	110	92	102	304
Total		407	395	414	1216

Green Manures.—*Gliricidia maculata* was planted throughout all replanted clearings as a green manure plant.

Buildings.

Frequent inspection of buildings during the course of construction has occupied a large part of the writer's time. This constituted a very comprehensive programme and the progress made is indicated in the figures appearing below :—

Buildings completed and in occupation :—

3 bungalows for Technical Officers.

1 bungalow for Chief Clerk.

3 bungalows for Junior Staff.

Administration block and extension to Chemical Laboratory.

Botanical Laboratory.

Buildings under construction :—

1 Junior Staff bungalow.

Preparation of a site for Director's bungalow is in progress.

Minor Buildings.—An 8 room set of single lines and a temple were constructed for the estate labour.

Water Scheme.—A well was constructed for augmenting the existing supply for extension to the Junior Staff bungalows. Preliminary trials conducted with regard to the water table gave indication of the prospects of a good supply. Pipe extensions were taken from the storage tank above the factory to connect up with a tank to serve the bungalows. The work is nearing completion.

NIVITIGALAKELE EXPERIMENT STATION.

Rainfall.—144·36 inches.

Tapping.—A total of 1,032 trees representing 11 clones in the 1926 clearing, 14 clones in the 1927 and 1 clone in the 1928 clearing were selected for tapping on semi-commercial lines. Cuts were opened at 2 ft. from the union and tapping started in April; the alternate day single cut system being employed. Yield records were kept for individual clones, the latex of each being bulked and the dry rubber content determined by hydrometer readings. At the early stages it was observed that some clones were prone to premature coagulation in the field, while a few others had not the necessary bulk for hydrometer determinations of the dry rubber content. In such cases the latex was converted to biscuits and the dry rubber determined directly by weighing.

Test Tapping.—Test tapping was continued in the 1926 and 1927 clearings as before and was extended to a further 41 clones in the 1928 clearing. The trees in test tapping during the year numbered 967.

A rubber curing shed and a small-holders' type of smokehouse (wattle and daub building) were constructed for dealing with the latex obtained from commercially tapped areas. The machinery consists of a smooth and grooved hand mill which were transferred from the laboratories at Culloden. Good quality smoked sheet is being turned out.

Pests and Diseases.—Early observation of the incidence of *Oidium* infection on some late "winterers" was followed by sulphur dusting treatment of the areas concerned, with very effective results. The attack of *Phytophthora* pod and leaf disease was very mild, which was evident from the absence of any secondary leaf fall.

Wind Damage.—A number of cases of wind damage occurred during the heavy monsoon gales in May and June. Several trees were either completely uprooted or partially damaged in the main stem and branches. Of the former, nearly all the damage was confined to trees with a malformed taproot system.

Albizzias.—The stand of Albizzias in Fields 4A, 4B and 4C of the 1928 clearing was thinned out by ring barking to about 10 trees per acre, evenly distributed over the whole area.

Manuring.—Manuring of old clearings was commenced late in July and completed in September. In the 1928 clearing the manure was applied on the platform up to 4 ft. from the tree, excluding the upper bund. As much green material as possible was incorporated into the furrows by envelope forking, together with the following mixture at 200 lbs. per acre:—

Calcium cyanamide	...	6 parts
Bonemeal	...	2 „
Saphos phosphate	...	1 part
Nitrate of potash	...	1 „

In the 1926 and 1927 clearings treatment consisted of the application of 200 lbs. sulphate of ammonia per acre, lightly forked on platforms without the incorporation of green manures.

Cover Crops.—Following the leaf fall during the wintering period, a very good growth of self sown *Centrosema* was observed in the 1926 clearing. This continued to thrive until growth was arrested by the heavy canopy of fresh foliage on the old trees. In order to stimulate and encourage further growth, the following artificial fertiliser was broadcast at 1 cwt. per acre with little result :—

Nitrate of soda	...	1 part
Saphos phosphate	... \	4 parts

The cover crop in the 1927 clearing appears to have suffered in the same manner and an attempt has been made recently to stimulate and restore its growth by manuring. In this connection, saphos phosphate has been broadcast at 100 lbs. per acre. It is too early yet to observe any results.

Nurseries.—The small holders nursery formed the main source of supply of budwood disposed of during the year and also of the stumped buddings required for the Dartonfield replanted area. After our own requirements had been fully met thinning out was done, the plants being spaced approximately 3 ft. by 3 ft. apart with a view to adapting this nursery for budwood multiplication. Selected clones for the Pinnagoda nurseries were supplied as stumped buddings from the plants so removed. The plants were pollarded and manured as soon as the thinning had been completed. Other nurseries of imported clones were similarly treated.

The budwood multiplication nursery consisting mainly of local clones was also pollarded.

1935 Clearing — Pinnagoda.

Budded Plants.—Growth was disappointing in the areas planted with seed for subsequent budding in the field and the plants were manured a few months before budding was started. The area is mainly being used for testing local clones using A.V.R.O.S. 50 as a control, as described in the report for 1935. Buddings have also been made from a number of seedling plants derived from the Prang Besar seed gardens with a view to establishing 3 budded plants from each seedling.

57 cross-fertilised seed from high yielding trees on a local estate have been planted out in this clearing. The same has been done with 28 seeds collected from trees of Clone Mal. 44A, which is regarded as a promising seed parent in Malaya.

Budwood Multiplication Nursery.—Reference was made in last year's report to the allocation of blocks in this area. A further block was formed from the remainder of the area. In accordance with the procedure described in the last annual report, the seedling plants in the groups of

each block were budded when they were sufficiently grown. Considering the unfavourable weather conditions during the budding operations, the final percentage of successes working out at 52 per cent. was not altogether disappointing. As stated earlier in this report, the number of budded plants was augmented by supplies of stumped buddings transferred from other nurseries.

Seedling Nursery.—Considerable thinning out of backward plants has been carried out, the total stand in this area being reduced to about 15,000 plants.

Seedling Nursery — 2 Acres.—5 acres of jungle land suitable for nurseries was acquired from Government in exchange for 5 acres from the balance of the 100 acre block leased by the Scheme. Clearing operations were completed over an area of 2 acres and 5,118 seeds were planted. It was not possible to complete planting the whole of this area owing to a shortage of seed at the time of opening the nursery. A further consignment of seed has now been ordered from an estate in the Moneragalla district.

D. L. NICOL,
Superintendent.

Dartonfield Estate,
Agalawatta,
February 11, 1937.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1936.

The Committee and Technical Sub-Committee held three meetings during the year.

Dr. H. A. Tempany, C.B.E., was co-opted on the Committee on retirement from Malaya.

The following members of the Boards and Staffs of the Rubber Research Institute (Malaya) and the Rubber Research Scheme (Ceylon) attended meetings of the Technical Sub-Committee and Committee during the year: Mr. O. T. Faulkner, Lt.-Colonel B. J. Eaton, Mr. H. J. Page, Mr. T. E. H. O'Brien and Mr. H. S. Blacklin.

Several conferences were held by the technical staff with the Directors of the Rubber Research Scheme (Ceylon) and the Rubber Research Institute (Malaya) on the investigations in progress at the Imperial Institute and in the East, and arrangements made for them to establish personal contact with representatives of manufacturing interests in this country.

Visits to the laboratories were also paid by Messrs. Beeley and Moore of the staff of the Rubber Research Institute.

At the request of the International Rubber Regulation Committee the activities of the Committee and the work in progress in the laboratories were discussed with M. Leon Enderlin in connection with an enquiry he was conducting as to the research which could most usefully be undertaken by the French Institution for Rubber Research.

FINANCE.

The expenditure incurred in connection with the work of the Committee during the year amounted to £3,230-12-11. After allowing for reserve for plant and for liabilities outstanding, there was an unexpended balance of £800 at 31st December, 1936.

During the year it was suggested to the Committee that the funds to be provided for research with a view to developing "new applications" of rubber under Article 19 of the Final Agreement embodying the terms and provisions of the International Rubber Regulation Scheme would not be available for the work carried out by the Committee as a complement to that of the Rubber Research Schemes in the East and that the financing of the London section of the work would have to be undertaken by these organisations and not by the International Rubber Research Board as had previously been assumed. This view was confirmed on enquiry of the

International Rubber Regulation Committee and it was proposed to the Boards in the East that, in order that a satisfactory scheme of work may be planned and reasonable security given to the staff, financial provision at the rate of £3,500 per annum should now be made for the continuation of the work in London for a period of five years.

In view of the great difference in rubber acreage in Ceylon and Malaya, the Committee expressed the opinion that the existing basis of equal contributions by the two countries is inequitable and, after consideration of all the circumstances, the following ratio was suggested — Ceylon 25 per cent. Malaya 75 per cent. Approval to this proposal has been given by the Ceylon Rubber Research Scheme, but at the time of the preparation of this report the official notification of the decision of the Board of the Rubber Research Institute (Malaya) had not been received, but it is understood that they have agreed to make the increased payment suggested for the year 1937.

APPOINTMENT OF STAFF IN MALAYA.

In accordance with the authority received from the Government of the Federated Malay States in 1935, steps were taken to fill the vacancy for a Director of the Rubber Research Institute caused by the retirement of Lt.-Col. B. J. Eaton, C.B.E. Twenty one applications were received in answer to the advertisement issued. These were carefully considered by a Sub-Committee, to one or more members of which all the candidates from overseas were known personally. The Sub-Committee were unanimously of opinion that the qualifications of Mr. H. J. Page, M.B.E., B.Sc., Comptroller of Agricultural Research at the Agricultural Research Station maintained by the Imperial Chemical Industries, Ltd., at Jealott's Hill were so outstanding that they were not justified in submitting any other name as an alternative for the consideration of the High Commissioner. The recommendation of the Committee was approved by the Government of the Federated Malay States and Mr. Page proceeded to Malaya in July.

At the request of the Board of the Rubber Research Institute, an advertisement was issued towards the close of the year, inviting applications for the following vacancies on the staff of the Institute:—

- (1) Botanist;
- (2) Advisory Officer, Botanical Division;
- (3) Advisory Officer, Soils and Chemistry Division; and
- (4) Junior Assistant, Experiment Station.

INVESTIGATIONS.

A detailed description of the technical work is given in the appendix and reference can most usefully be made here to those investigations which are developing beyond the laboratory stage and to the principal new lines of work undertaken during the year. A list of the reports furnished to Ceylon and Malaya is given at the end of this report.

For many industrial uses uniform high grade latex is required and it is necessary, therefore, that a satisfactory testing method should be available. As a result of considerable experimentation simple and suitable coloured standards for general use by the trade have been devised and submitted to the Rubber Trade Association who are giving them favourable consideration. In view of the fundamental importance of stability (rate of decrease in resistance to coagulation) considerable attention is being given by rubber technologists to formulating a satisfactory test but general agreement has not been reached as to the best procedure. The method now under consideration by the Committee promises to be satisfactory.

Among a number of other latex investigations carried out during the year the study of the lowest temperature which different types of preserved latex will withstand without coagulation and the development of the apparatus devised in the laboratories for the concentration of latex by evaporation, are of special interest.

Two products which may be of industrial value (1) as a moulding powder, and (2) for the manufacture of superior ebonite were obtained during a study of the chlorination and bromination of a sample of acid latex and the Rubber Growers' Association and the Research Association of British Rubber Manufacturers were asked to arrange for technical trials to be carried out on these materials.

One of the materials prepared in the experiments which have been proceeding at the Rubber Research Institute with the object of obtaining a special type of rubber having a low water absorption to meet the requirements of the electrical industry has attracted considerable attention by manufacturers in this country, and several requests for samples and enquiries as to the conditions under which commercial supplies could be obtained have been received.

Work was continued in close association with the Limmer and Trinidad Lake Asphalt Company on the use of an asphalt rubber mixture as a binding material for highway surfacing, for which a grant has been received during recent years from the R. G. A. Technical Research Committee. The section of roadway laid by the Company in 1935 and referred to in the Committee's report for that year continues to show satisfactory non-skid properties, presumably due to the effect of rubber on the flow of the bitumen, and arrangements have been made for a more extensive trial on the public highway early in 1937. In this trial tests will be made not only with the mixture previously employed but with others since developed as a result of joint research carried out during the year in conjunction with the staff of the Limmer and Trinidad Lake Asphalt Company and which, it is anticipated should not only be equally satisfactory but should also be more convenient for use by the highway engineer.

Considerable assistance in this work was rendered by Mr. D. C. Broome, research chemist of the Limmer and Trinidad Lake Asphalt Company whose laboratory investigations furnished very useful information as

to the conditions under which rubber can most usefully be employed in asphalt mixtures.

A paper by Mr. W. S. Davey, B.Sc., describing some of the work carried out on the use of rubber in bitumen for road surfacing materials was published in the Bulletin of the Rubber Growers' Association for May, 1936.

There is also useful progress to report in connection with the systematic study commenced last year of the preparation and properties of latex-cement mixtures for roadways, pavements and flooring for which work a special grant was made by the Rubber Research Institute (Malaya) for a period of three years.

Methods have been devised for controlling shrinkage which is one of the principal difficulties experienced in the use of latex-cement mixtures and also for the use of Portland cement in place of the more expensive aluminous cement, enabling a wider range of attractive products to be obtained.

Samples illustrating the use of latex-cement mixtures as an adhesive for glass or glazed tiles to cement were supplied to the Rubber Growers' Association for display on the Association's stand at the building and other exhibitions, and arrangements were made for enquirers to be supplied with specially compounded latex suitable for the purpose.

Close co-operation has been maintained through the work with the investigations on road surfacing which are being carried out under Professor R. G. H. Clements in the Highways Laboratory at the City and Guilds' Engineering College. This co-operation has been especially helpful in regard to the mechanical testing of latex-cement mixtures and joint experimental work is now in progress.

CO-OPERATION WITH OTHER ORGANISATIONS.

Co-operation on the usual lines was maintained with the Rubber Growers' Association, the Research Association of British Rubber Manufacturers, the Rubber Producers' Research Association, the American Chemical Society, the British Standards Institution, the Electrical Research Association and with other research and trade organisations mentioned in previous reports. The discussions covered a wide range of subjects affecting various technical activities of the Committee but there is no important development to report in this connection.

PATENTS.

As in previous years, abstracts of English patent specifications in respect of inventions relating to processes for the preparation and/or utilisation of raw rubber and latex were made for the information of the Rubber Growers' Association, the Rubber Research Scheme (Ceylon) and the

Rubber Research Institute (Malaya) and copies of specifications of special interest were obtained for the research organisations in the East.

In conjunction with the Rubber Producers' Research Association steps were taken to obtain English patents in connection with inventions arising out of the work of the staffs in London and in the East.

Applications Sealed During 1936.

444,925.—Concentration of latex — Reciprocating Surface Process of Evaporation.

450,222.—The use of hemi-cellulosic and linseed-cake meal extracts as creaming agents.

Complete Specifications Filed During 1936.

12,053/36.—Improvement of the centrifugal concentration of latex by the addition of organic liquids. (Communicated by the Rubber Research Institute).

Provisional Specifications Accepted During 1936.

12,781/36.—The preservation of latex by the use of an acid. (Communicated by the Rubber Research Institute).

14,704/36.—Chlorination of nitrite crumb.

16,615/36.—Preparation of chlorinated rubber from latex.

19,543/36.—The preparation of softened rubber from stearate crumb. (Communicated by the Rubber Research Scheme, Ceylon).

23,187/36.—Concentration of latex by 'creaming with a vegetable powder. (Communicated by the Rubber Research Institute).

23,188/36.—Preparation of brominated rubber from latex.

28,735/36.—Process for obtaining a very stable creamed latex by the use of a synthetic creaming agent (Communicated by the Rubber Research Institute).

30,770/36.—Process for improving the properties of latex-cement mixtures for use in flooring, etc.

REPORTS ON INVESTIGATIONS FORWARDED TO CEYLON AND MALAYA DURING 1936.

Latex Testing and Specification.

Latex specification — colour of latex.

Stability of latex.

Creaming of Latex.

Latex concentration (creaming).

Latex creaming agents prepared from linseed-cake meal.

Comments on tests in Malaya on synthetic creaming agents prepared in London.

Latex creamed with vegetable powder.

Hemicellulose and linseed-cake meal creaming agents for latex.

Preservation of Latex.

Preservation of latex with chemicals other than ammonia.

Latex containing an acid preservative.

Latex (general).

Quality of latex from Dartonfield Estate, Ceylon.

Coagulation of latex on freezing.

Miscellaneous reports on quality of latex.

Investigations connected with the preparation of rubber.

Softened rubber prepared in Ceylon.

Clone rubbers from Malaya and Netherlands East Indies.

Chlorinated and brominated derivatives of rubber prepared in London from preserved latex.

Miscellaneous.

Malayan mineral filler submitted to the Rubber Research Institute, Malaya.

Quarterly progress reports on investigation of cement-latex mixtures.

P. G. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

February, 1937.

TECHNICAL APPENDIX TO REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1936.

LATEX.

(1) **Specification and Testing.**—As in 1935 considerable attention was paid to devising and developing methods for determining the quality of latex, especially the preparation of colour standards for liquid latex and methods for determining stability.

In order to obtain suitable standards the colour of many samples of latex was analysed by means of the Lovibond Tintometer, an apparatus which gives a numerical measure of colour in terms of the primary colours red, yellow, and blue. The values given by latex are very small, and the apparatus is not altogether suitable for routine tests, but the information obtained was useful in the preparation of colour mixtures for matching individual samples of latex.

Although latex varies considerably in colour no difficulties in matching were experienced, but the principal problems were to devise a simple and suitable form of matching outfit with a limited number of colour slides having colours which are permanent, reproducible and moisture-proof. As freshly tapped latex may vary from practically pure white to yellowish white and may darken on storage, four different mixtures of titanium dioxide (white) and cadmium sulphide (yellow) were prepared using sodium silicate as a binder. To each was added a range of amounts of lamp black, giving a series containing 24 colour slides. It was found however that the dominant factor was the grey colour which masked the yellow and resulted in different observers matching a given sample with slides containing the same amount of carbon black but different amounts of cadmium sulphide.

After consultation with trade interests a modified outfit of colour slides was accordingly prepared consisting of nine shades using the same component materials in varying amounts, the basic colour being white with a very slight trace of yellow. The adoption of the colour standard outfit was under consideration by the Latex Joint Sub-Committee of the Rubber Growers' Association and the Rubber Trade Association at the end of the year.

Work was continued with the object of devising a suitable stability test for latex and particular attention given to the method referred to in the last report involving stirring in the presence of zinc oxide. The

apparatus for this purpose was designed and constructed in the Committee's workshops and duplicate apparatus supplied to the Rubber Research Scheme (Ceylon) and to the Rubber Research Institute (Malaya).

In view of the irregular results given by this method a study was made of the following variable factors: (1) The quantity of latex of a fixed dry rubber content, (2) The amount and grade of zinc oxide, (3) The speed of stirring, (4) The ammonia content of the latex, and (5) The temperature of testing. Following this investigation standardised conditions were adopted enabling satisfactory reproducible results to be obtained.

The chief defect of the test is the time required for coagulation with zinc oxide (from 1 hour to more than 24 hours). Other coagulants are being tried and sodium silicofluoride appears promising because it enables the test to be carried out in a few minutes and it is not necessary to standardise the amount and grade as in the case of zinc oxide. Experiments are also being made with increased speeds of stirring.

A method for determining stability by very rapid stirring in use in America was submitted to a preliminary investigation, but it was found difficult to obtain a satisfactory end point and for some latices the method appeared to be altogether unsuitable.

(2) **Freezing of Latex.**—Latex is now being exported to countries where temperatures below 0°C are frequently encountered, and during the year enquiries were received from brokers as to the lowest temperature which preserved latex will withstand without coagulation. As no definite information on the subject could be obtained from a study of the literature and from enquiries made in the United States of America, preliminary tests were carried out in which different types of commercial latices were frozen to a solid mass at temperatures between -12°C . and -20°C . After subsequent storage at room temperature some types reverted to liquid latex but others were found to be coagulated. Creamed and centrifuged latex showed the greatest tendency to coagulate on freezing (after two days at -12°C), which was found to be due to the removal of serum substances. Revertex showed greater resistance to coagulation than any other type of concentrate. There was variation in the behaviour of 38/40 per cent. latex from different sources, but some samples after being kept for ten days at -20°C reverted completely to latex on thawing. Coagulation was retarded by the addition of ammonia or protective colloids such as saponin.

(3) **Preservation of Latex.**—(a) *Dartonfield Latex.*—Among the samples of latex examined, one drawn from the first trial consignment shipped from Dartonfield Experimental Station of the Ceylon Rubber Research Scheme is of special interest. The latex, which was prepared in accordance with the recommendations of the Rubber Research Institute (Malaya) was of excellent quality both as regards the colour of the latex and of the dried film, freedom from solid matter, high stability and film strength.

(b) *Disinfectants*.—In continuation of the experiments of the Rubber Research Institute referred to in the last report, further samples of latex preserved with chemicals other than ammonia were received for examination. Some of the disinfectants were satisfactory preservatives, but it was necessary to add a small amount of ammonia in order to reduce the viscosity to that of ammonia preserved latex. On the whole the samples were of excellent quality and very suitable for commercial use, but the strongly poisonous character of the preservatives used is a distinct disadvantage.

Discussion with the Rubber Growers' Association led to experiments by the Rubber Research Institute on the preparation of latex with an acid reaction, and it was discovered that one of the acids frequently used as a coagulant would preserve undiluted field latex for long periods when used in suitable proportions. On arrival in this country the latex contained $7\frac{1}{2}$ per cent. of its weight of rubber in the form of coagulum and the surface froth showed a marked tendency to coagulate. A further sample containing saponin was free from coagulum and the froth did not coagulate so readily. Although the dry rubber obtained from the latex by coagulation with ammonia was of excellent quality the scope for commercial utilisation in directions where acid latex may have advantages is greatly limited by the difficulty experienced in compounding with the usual vulcanising agents, even in the presence of stabilising agents. After sundry trials the most promising outlet appeared to be for the preparation of chlorinated rubber and this led to a somewhat extensive investigation described in section 5 of this report.

(4) **Latex Concentration**.—(a) *Creaming*.—As indicated in the report for 1935 aqueous extracts of linseed cake meal appeared to be one of the most promising creaming agents discovered in the Committee's laboratories. This material is obtained from many countries and a set of crude and purified extracts was accordingly prepared from meal of widely diverse origins for trial in Malaya with fresh latex.

According to a report from the Rubber Research Institute the extracts were on the whole good creaming agents but a higher concentration was necessary than is customary when using tragon seed gum. The purified materials were in most cases more efficient than the crude extracts.

Reports were also received from the Rubber Research Institute on the methylated starch and hemicellulose prepared during 1935. The results confirmed that these materials were creaming agents of latex, but the dry rubber content of the concentrates was not sufficiently high to warrant further work with a view to commercial application. In view of the discovery by the Institute of a local source of new and cheap creaming agents of considerable promise, the work in London has been discontinued for the time being. A sample of latex prepared in Malaya with this creaming agent was found to be satisfactory, although prepared from latex which was somewhat abnormal as regards stability.

Further experiments on the concentration gradient in the cream layer led to the development of a continuous process for latex creaming in which the highly concentrated surface layer is removed. If the rate of removal of this layer is sufficiently slow it is obvious that a higher concentration than usual must be obtained, but owing to the very slow rate of flow required in small scale experiments it is difficult to determine in London whether the method is practicable on a large scale. The present procedure recommended by the Rubber Research Institute to estates involves the removal of 80 per cent. of the cream every 48 hours, and as the staff of the Institute are of opinion that the advantages of the continuous process are unlikely to warrant any alteration, no further action is being taken.

(b) *Evaporation*.—The apparatus developed in the London Advisory Committee Laboratories and referred to in the last report was despatched to the Rubber Research Institute (Malaya). Considerable attention had first to be paid to the surface treatment of the metal parts in order to avoid discolouration of the latex. Experiments were made with proprietary paints, chlorinated rubber, bitumen and chromium and rhodium plating. None was entirely satisfactory, but it was decided to adopt rhodium plating which appeared to be the most promising treatment. This however, proved to be unsatisfactory in tests carried out in Malaya, and in the apparatus supplied subsequently to the Director of the Rubber Research Institute at his request it was decided to use stainless steel.

A sample of latex concentrated in the apparatus in Malaya to a dry rubber content over 68 per cent. without the addition of protective colloids was found to be of satisfactory quality on examination in London and was favourably reported on by the trade, who have requested a larger sample.

(c) *Filtration*.—At the request of the Rubber Research Institute preliminary experiments have been made in London with a view to obtaining the best materials for use in concentrating latex by a method of filtration suggested by the staff of the Institute. A sample of latex prepared by this method in Malaya was examined in London and found to be satisfactory.

(d) *Centrifuging*.—Two interesting samples of concentrated latex consisting of (a) ordinary centrifuged cream, and (b) centrifuged concentrate prepared from the skim fraction were prepared in Malaya at the request of the Committee. Microphotographs indicated a preponderance of large particles in the centrifugal cream and small particles in the concentrate from the skim. There was however no complete separation of large and small particles in either latex and it was considered that the concentrate from the skim would not have any enhanced practical value, as, for example, in proofing.

(5) **Halogen Derivatives of Rubber from Latex**.—With a view to finding a use for the acid latex from Malaya (see Section (3) (c)) it was treated with chlorine gas for the purpose of obtaining chlorinated rubber, but the coagulation of the froth caused considerable difficulty. This difficulty was avoided on using chlorine water instead of gas but it was found

more convenient to chlorinate with a mixture of hydrochloric acid and sodium chlorate. The method was also found to be suitable for the chlorination of suitably stabilised ammoniated latex. In the presence of excess reactants finely divided white or pale cream powders were obtained, which contained over 50 per cent. combined chlorine and swelled considerably in most solvents without dissolving. Numerous attempts to obtain a soluble product containing over 60 per cent. combined chlorine suitable for paint manufacture were unsuccessful. The products obtained could be moulded at temperatures from 110° to 130°C , and a sample was sent to the Rubber Growers' Association for use in their experiments on expanded chlorinated rubber.

Partially chlorinated products obtained with smaller amounts of hydrochloric acid and sodium chlorate and partially brominated rubbers, prepared by the addition of bromine water to stabilise ammonia preserved latex or acid latex were superior after vulcanisation to plantation rubber as regards resistance to oils and solvents, but were decidedly inferior to the synthetic materials Duprene and Thiokol. The brominated proved to be more stable than the chlorinated rubbers.

Interesting features of partially halogenated rubbers are: (1) the property of vulcanisation in the presence of zinc oxide without sulphur, (2) the increased speed of reaction with sulphur at vulcanising temperatures, and (3) the comparative inertness of accelerators. A range of hard rubbers prepared from the brominated material appeared to have a higher softening point than ebonite and in view of their promising character were sent to the Research Association of British Rubber Manufacturers for an opinion as to their suitability for industrial purposes.

(6) **Road Surfacing and Flooring Materials.**—The work on road and floor surfacing materials commenced last year has been largely devoted to a study of mixtures of latex and aluminous cement, but attention has also been given to the possibility of using Portland cement.

The work carried out during the year on aluminous cement-latex compositions comprises (a) a microscopic study of the structure of the finished product, (b) an attempt to follow the processes of hydration during the mixing and setting of the material, (c) an examination of the mechanical properties of the products obtained, (d) a study of the physical properties of the mixture which require consideration in connection with practical processing such as speed of setting, shrinkage, etc.

The usual methods of section cutting and polishing were not suitable for studying the micro structure of cement latex mixtures owing to the composite nature of the material, which contains both soft rubber and very hard cement grains. Attempts to cut sections of the material frozen in solid carbon dioxide and to grind sections immersed in liquid air were unsuccessful as it was not possible to obtain a sufficiently thin section or a good polished surface. Various other methods were attempted and finally success was attained by grinding and polishing small

pieces of the material vulcanised to a hard condition by immersion in molten sulphur. By this means the structure of cement-latex mixtures was shown to consist of incompletely hydrated cement grains embedded in a matrix of cement hydration products and rubber. The matrix appears to comprise a continuous phase of rubber, in which are distributed the cement hydration products. In the harder and more cementitious materials the hydration products form a second continuous phase, interlocking with the rubber, but in the softer materials they are dispersed throughout the rubber and function only as a filling material.

It is generally assumed that the purpose of adding cement to latex is to fix the free water by chemical means. The amount of combined water in cement-latex mixtures was found to depend almost entirely on the nature of the stabilising agent present in the latex and was generally not greater than 3 per cent. calculated on the cement except in the presence of caustic potash when the combined water amounted to 11 per cent., an amount similar to that which combined with cement under comparable conditions in the absence of latex and potash. Mixtures containing a high proportion of combined water were much harder than those in which only a small amount of hydration occurred.

The machines ordinarily employed for testing rubber or cement are unsuitable for determining the mechanical properties of cement-latex mixtures. A machine for testing tensile strength of the mixture and another for measuring coefficient of restitution have been designed and constructed in the workshops of the department. Examination of materials containing varying proportions of rubber to cement has shown that the resiliency increase with the proportion of rubber present and that very different products are obtained by varying the nature and amount of the protective colloid in the latex.

Microscopic examination and hydration experiments indicated that much of the cement plays the part of an inert filler. Further experiments with certain mixtures showed that no falling off in the mechanical properties occurred when one-third of the cement was replaced by an inert filler such as limestone dust, but when two-thirds were replaced a slight decrease in strength was observed; with all the cement replaced by an inert filler, a very weak product was obtained.

Although cement does not completely dehydrate latex and can in some cases be partly replaced by an inert filler it undoubtedly serves an essential purpose in promoting quick setting and mechanical rigidity.

It is considered essential that material to be used for road or floor surfacing should remain "workable" for at least three quarters of an hour in order to allow adequate time for mixing and laying and that it should set sufficiently hard to bear light traffic within twenty four hours. By the addition of protective colloids and certain other materials, in carefully controlled proportions, to cement-latex mixtures, it was found possible to adjust the workable period and setting time within fairly wide limits.

Preliminary studies indicated that the shrinkage which frequently occurs with cement-latex mixtures is connected with the relative amounts of water combined with the cement and that lost by evaporation. A method of controlling this loss was devised and evidence was obtained that shrinkage can be considerably reduced.

The use of the comparatively expensive aluminous cement is due to the fact that cheaper cements such as Portland cause immediate coagulation on mixing with latex. This coagulation can be avoided by the addition of large quantities of a protective colloid which interferes however with the setting of the cement and results in a much inferior product. One of the causes of coagulation was found to be the presence of gypsum which is invariably added to the Portland cement clinker before grinding. Tests made with Portland cement ground with and without gypsum have shown that the addition of gypsum gives rise to more rapid coagulation of the latex, increases the time of hardening of cement-latex mixtures beyond practicable limits and results in a weaker product. As Portland cement is much lighter in colour than aluminous cement it is possible by omitting the addition of gypsum during manufacture to obtain satisfactory rubber-cement products in bright colours particularly attractive for flooring.

During the year an enquiry was received for a suitable adhesive for attaching glass to Portland cement which is of importance in connection with some types of building. Cement-latex mixtures were known to be promising and a few experiments were made and samples prepared to demonstrate their value for the purpose. Samples were shown including the fixing of glazed tiles to cement at the Building Exhibition at Olympia and a few enquiries were received and referred to suppliers of latex suitable for the purpose.

RUBBER.

(1) **Nitrite Crumb.**—Reference was made in the last report to an experimental highway in which the binding material is a mixture of asphalt and rubber crumb prepared by a method devised by the London Advisory Committee Staff (B.P. 395,755). The roadway continues to give satisfactory results and still retains a better matt non-skid surface than the asphalt control. In view of the possible importance of this development to the plantation industry arrangements were made with the Rubber Growers' Association and the Limmer and Trinidad Lake Asphalt Co. for closer laboratory co-operation and for further large scale trials.

The joint laboratory work has indicated that it is not necessary to dissolve the crumb in the bitumen thus reducing the cost of preparation and that latex can be used with greater facility than crumb and much less rubber is required to achieve a given effect. Laboratory tests have also shown that rubber confers superiority on asphaltic cement mixtures in respect of (1) softening point, (2) ductility, (3) elasticity, (4) resistance to flow, (5) susceptibility factor, (6) asphalt-viscosity index, and (7) fluidity factor.

A material possessing these advantages should inevitably show a less tendency to "flush-up" on the road and if the original specification is such as to give a non-skid surface there is a fair degree of certainty that it will remain in a similar condition. One of the defects to which certain types of bituminous road surfacings are subject is the gradual displacement of the chippings originally forming the riding surface by a smooth film of "liquid" bitumen, and it is felt as a result of the present work that the risk of such a transition is materially reduced with asphaltic cements of the type under consideration when made into asphalt mixtures.

Attempts were made to determine in the laboratory the effect of rubber on the properties of materials of asphaltic cement with aggregate, but the results are somewhat irregular and there is some doubt as to the practical value of the information obtained. Data have been obtained, however, which have an important bearing on the nature and properties of the materials to be employed in large scale trials.

Arrangements have been made for three trial sections of road to be laid early next year, viz. one similar to that laid previously in which the crumb was uniformly dispersed in the bitumen, another in which the crumb is mixed with the bitumen without solution and a third with rubber in latex form.

(2) **Rubber for Use in the Electrical Industry.**—Experiments have been proceeding at the Rubber Research Institute with the object of preparing a special type of rubber having a low water absorption due to the removal of part of the serum substances generally present in standard grades of rubber. Samples have been received which absorb from a damp atmosphere about one-quarter of the amount of moisture absorbed by average crepe. Arrangements were made for technical trials with this rubber by manufacturers suggested by the Research Association of British Rubber Manufacturers.

(3) **Softened Rubber.**—A sample of softened rubber prepared by the Ceylon Rubber Research Scheme from rubber in crumb form was found to have similar vulcanising and ageing properties to those of some grades of commercial softened rubber, but its manipulative properties were not so satisfactory.

(4) **Vulcanised Crepe.**—Two samples of vulcanised crepe prepared by the Ceylon Rubber Research Scheme were examined by immersion in boiling water, freezing and swelling in organic solvents. The value of the material for use in moulding Portland cement, plaster etc. with a view to giving a "key" for attachment to other materials or for the purpose of producing a pleasing appearance was demonstrated at the Building Exhibition held at Olympia.

(5) **Clone Rubber.**—A number of samples drawn from well known clones were examined during the year, and considerable data are being

accumulated concerning the quality of the rubber from different sources. It is proposed to prepare a critical review when sufficient information has been obtained to draw authoritative conclusions.

Rubber-Shellac Mixtures.—A process has been devised in conjunction with Mr. A. K. Thakur of the Indian Lac Research Institute for obtaining a moulding powder consisting of an intimate mixture of shellac and unvulcanised rubber, with the addition of vulcanising ingredients and other fillers if desired. A set of samples has been prepared and forwarded to the London Shellac Research Bureau, for submission to different authorities with a view to determining their suitability for a number of purposes.

G. MARTIN.

Superintendent of Rubber Investigations.

Imperial Institute,
London, S.W. 7.

AUDITOR-GENERAL'S REPORT FOR 1936.

The Chairman,
Board of Management,
Rubber Research Scheme,
Peradeniya.

Sir,

I have the honour to report that the audit of the accounts of the Rubber Research Scheme for the year 1936, has been completed and have pleasure in forwarding the following documents duly certified:—

- (a) Income and Expenditure Account for the year, 1936.
- (b) Balance Sheet as at December 31, 1936.
- (c) Statement of Receipts and Payments of Officers' Provident Fund Account for 1936.

I. Income.

2. The total income which accrued during the year amounted to Rs. 177,686. It exceeded the estimate of Rs. 170,600 by Rs. 7,086 and the income of the previous year by Rs. 4,339.

3. *Cess Collections.*—The amount which accrued for the year was Rs. 140,533 inclusive of the collections amounting to Rs. 10,092 made by the Principal Collector of Customs during December, 1936, and paid into the credit of the Scheme in January, 1937. The income on this account for the year fell below the estimate by Rs. 13,467 and also the income of the previous year by Rs. 13,863

4. *Interest.*—The amount earned in respect of the year was Rs. 4,198 as against Rs. 5,354 for the previous year. The estimated income on this account for the year was Rs. 4,000.

5. *Sale of Publications and Subscriptions.*—The amount realised for the year was Rs. 501 as compared with Rs. 401 for the previous year.

6. *Sundry Receipts.*—A sum of Rs. 410 was collected under this head for the year. It exceeded the estimate for the year by Rs. 210 chiefly as a result of the receipt of a share of the fees received by an officer for attendance at the meetings of the Budded Rubber Assessment Board.

7. *Profit from Dartonfield Estate.*—The income of the estate for the year under review was Rs. 42,351 and the expenditure in working was Rs. 16,086. The profit in working the estate for the year was therefore Rs. 26,265. The Estate Returns in support of expenditure and the Sale Statements of rubber in support of income were examined.

8. *Profit from Nivitigalakele.*—The receipts from the sale of rubber, budwood, budded stumps and cover crop seeds at Nivitigalakele amounted

to Rs. 10,047 and the expenditure on the production amounted to Rs. 4,267, leaving a profit of Rs. 5,780 for the year under review.

II. Expenditure.

9. *Revenue Expenditure*.—The total expenditure on Revenue Account exclusive of the amounts allowed for depreciation on capital assets and for Passage Fund Reserve amounted to Rs. 114,641 as compared with Rs. 114,036 of the previous year. Details of this expenditure are fully set forth in the Income and Expenditure Account. The whole of this expenditure except the expenditure incurred by the London Committee from the contribution of Rs. 18,570 made by the Board was checked with supporting vouchers and accounts. The audited statements of expenditure by the London Committee have not yet been received.

10. *Capital Account*.—The expenditure charged to Capital Account amounted to Rs. 113,423. The details of this expenditure are as follows:—

Dartonfield Estate:—

Property:—

		Rs.	Rs.
Agricultural Development	...	2,775	
Fencing, Roads, Survey, etc.	...	3,658	6,433

Buildings:—

Administration Block	...	12,184	
Botanical Laboratory	...	13,824	26,008
Bungalows	...	38,606	
Estate Buildings	...	3,403	42,009

Furniture, Fittings and Office Equipment:—

Administration Block	...	540	
Botanical Laboratory	...	1,163	
Bungalows	...	3,816	5,519

Water Supply:—

Administration Block	...	280	
Botanical Laboratory	...	1,910	
Bungalows	...	7,229	
Water and Lighting Scheme	...	6,966	16,385

Machinery and Tools:—

Administration Block	...	396	
Botanical Laboratory	...	1,780	
Bungalows	...	2,152	
Experimental Machinery	...	6,457	10,785

Nivitigalakele:—

Property:—

Agricultural Development	...	3,146	
Pinnagoda New Clearing Development	...	875	
1936 Nurseries	...	648	4,669

Buildings :—

Factory	...	...	859
Water Supply	...	...	123
Machinery and Tools	...	...	105
Laboratory Apparatus	...	...	528
			<u>113,423</u>

11. A statement showing the excesses on votes and the unspent balances with the explanation of the Director of Research for the principal variations is given below. Sanction for the excess has to be obtained.

Head of Expenditure	Estimate		Actual Expenditure		Savings	Excess
	Rev.	A/c.	Cap.	A/c.		
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
I. Personal Emoluments:—						
A. 1-5 Salaries of Technical Officers	54,165	53,670	—	495	—	—
6 Salary of Secretary to Director	3,000	3,000	—	—	—	—
7-13 Salaries of Subordinate Staff	8,224	7,762	—	462	—	—
14 Rent Allowances	585	631	—	—	—	46
15 Contribution to Provident Fund	3,145	3,871	—	—	—	726
II. Other Charges:—						
B. 16a Laboratory Upkeep, Chemicals and Apparatus	5,000	2,409	528	2,063	—	—
16b Samples for London Experiments	500	—	—	500	—	—
16c Dusting Experiments	1,000	40	—	960	—	—
16d Routine tests on Chemicals	100	—	—	100	—	—
C. 17a Upkeep of Buildings	1,000	277	—	723	—	—
17b Insurance	1,000	1,296	—	—	—	296
17c Upkeep of Water Supply	350	453	—	—	—	103
17d Upkeep of Roads	200	62	—	138	—	—
17e Furniture Replacements	50	46	—	4	—	—
D. 18a Printing and Advertising	1,500	1,908	—	—	—	408
18b Stationery	1,500	1,391	35	109	—	—
18c Postages	1,500	1,262	—	238	—	—
18d Books and Periodicals	600	733	—	—	—	133
18e General Charges	750	821	—	—	—	71

Head of Expenditure		Estimate	Actual	Expenditure	Savings	Excess
		Rev.	A/c.	Cap.	A/c.	
		Rs.	Rs.	Rs.	Rs.	Rs.
18f	Audit and Accountancy	550	494	—	56	—
18g	Telephones	1,728	1,123	—	608	—
E. 19a	Travelling Expenses of Staff	5,000	5,880	—	—	880
19b	Travelling Expenses of Board Members	1,250	987	—	263	—
F. 20	Nivitigalakele Upkeep Charges	3,661	1,630	1,630	358	—
G. 21	London Advisory Committee	18,900	18,570	—	330	—
H. 22	Passage Fund Reserve	1,250	1,250	—	—	—
I. 23	Depreciation A/c.	14,700	16,090	—	—	1,390
J. 24	Dartonfield Experimental Account	9,075	7,952	—	1,123	—
III. Capital Expenditure:—						
K. 25a	Dartonfield Estate Cart Road	4,000	—	3,582	418	—
25b	Dartonfield Estate Replanting 10 acres	2,050	—	1,971	79	—
25c	Dartonfield Estate Replanting $\frac{1}{4}$ -acre	50	—	—	50	—
25d	Dartonfield Estate Upkeep of Immature Areas	929	—	852	77	—
25e	Dartonfield Estate Extension of Main Laboratory	17,000	17	13,365	3,618	—
25f	Dartonfield Estate Senior Staff Bungalows	35,516	12	34,157	1,347	—
25g	Dartonfield Estate Chief Clerk's Bungalow	5,500	—	4,554	946	—
25h	Dartonfield Estate Junior Staff Bungalows	18,836	—	13,070	5,766	—
25i	Dartonfield Estate Line rooms	3,000	—	2,849	151	—
25j	Dartonfield Estate Minor Buildings	460	—	265	195	—
25k	Dartonfield Estate Experimental Machinery	8,337	—	6,457	1,880	—
25l	Dartonfield Estate Botanical Laboratory Apparatus	3,000	—	—	3,000	—

Head of Expenditure		Estimate	Actual	Expenditure	Savings	Excess
		Rev. A/c.	Cap. A/c.			
		Rs.	Rs.	Rs.	Rs.	Rs.
L. 26a	Nivitigalakele					
	Agricultural					
	Development	2,335	314	1,516	819	—
26b	Pinnagoda Agricultural					
	Development	1,555	779	875	—	99
26c	Nivitigalakele Buildings					
	and Machinery	1,425	—	1,088	337	—
M. 27a	Dartonfield Estate					
	Botanical Laboratory	18,481	21	18,678	—	176
27b	Dartonfield Estate					
	Water and					
	Lighting Scheme	8,865	30	6,966	1,869	—
27d	Dartonfield Estate					
	Superintendent's					
	Bungalow	310	13	297	—	—
27e	Dartonfield Estate					
	Fencing	220	—	76	144	—
27f	Pinnagoda Nursery	517	—	648	—	131

A. 13. Appointment of Assistant postponed.

A. 15. Underestimate of requirements.

2B. 16a. Postponement of expenditure.

2B. 16b. Expenditure not required.

2B. 16c. Expenditure not required owing to Government grant.

2B. 16d. Expenditure not required.

2C. 17a. Economies owing to transfer of headquarters.

2C. 17b. Certain buildings insured for longer period than one year.

2C. 17c. Extra cost of carrying water to Junior Staff Bungalows at Dartonfield.

2C. 17d. Economies owing to transfer of headquarters.

2D. 18a. Extra cost of press advertisements.

2D. 18e. Includes transport charges for transfer of headquarters.

2D. 18g. Telephone extensions not installed until January, 1937.

F. 20. Economies.

2G. 21. Saving on exchange rates.

2i. 23. Underestimate of requirements.

3K. 25a. Work not completed.

3K. 25e. Work not completed.

3K. 25f. Payments not completed.

3K. 25g. Payments not completed.

3K. 25h. Work not completed.

3K. 25i. Economies.

3K. 25j. Economies.

3K. 25k. Postponement of expenditure.

- 3K. 25l. Postponement of expenditure.
- 26a. Alteration of weeding and manuring programme, economies and overestimate of requirements.
- M. 26a. Savings owing to transfer of equipment from Culloden.
- M. 27a. Payments not completed.
- M. 27b. Work not completed.
- M. 27e. Work not completed.
- M. 27f. Extra cost of removing stumps.

III. Balance Sheet.

(a) *Liabilities.*

12. *Contribution to Capital Outlay—Rs. 546,040.*—This sum represents the total amount spent on the existing Capital Assets of the Board. The amount spent on this account up to the close of the previous year was Rs. 482,561. The expenditure during the year under review was Rs. 113,423 bringing the total contribution to Capital Outlay to Rs. 595,984. The loss of Rs. 49,944 on the sale of the buildings, etc., at Culloden Estate during the year was charged to this account, reducing the total on this account to Rs. 546,040 which is the sum shown in the Balance Sheet.

13. *Sundry Creditors — Rs. 5,311.*—So far as it can be ascertained all outstanding liabilities on December 31, 1936, have been brought to account with the exception of the cost of audit for 1936, amounting to Rs. 582.37.

14. *Electric Light Account — Rs. 362.*—This sum represents the difference between the amount of recoveries made from the staff for the supply of electric current to their bungalows and the cost of supply.

15. *Deposit for Supply of Budwood and Budded Stumps in 1937 — Rs. 777.*—This sum represents the amount of the advance recoveries against the supply of budwood and budded stumps in 1937.

16. *Deposit for Supply of Cover Crop Seed in 1937 — Rs. 49.*—This sum represents the amount paid in advance against the supply of cover crop seed in 1937.

17. *Sulphur Dusting Scheme by Government Grant — Rs. 5,501.*—This amount represents the unexpended balance of the Government Grant of Rs. 20,000 and the sum of Rs. 550 received from the estates during the year for work in connection with the sulphur dusting scheme. The total expenditure on the scheme amounted to Rs. 15,049 of which Rs. 14,212 represents the amount of expenditure incurred during the year under review and the balance Rs. 837 represents the amount advanced from the funds of the Board for expenditure on sulphur dusting in 1935.

18. *Depreciation Cash Reserve Account — Rs. 37,838.*—This sum represents the amount set apart for the depreciation of the buildings, plant, etc., belonging to the Board. The amount transferred from revenue to this account during the year was Rs. 16,090 made up as follows :—

Culloden Estate.

	Rs.	cts.
Buildings at 4% on Rs. 39,696·84	1,587	87
Furniture, Fittings and Office Equipment at $7\frac{1}{2}\%$ on Rs. 5,804·86	435	36
Water Supply at $7\frac{1}{2}\%$ on Rs. 1,402 62	105	20

Dartonfield Estate.

Buildings at 4% on Rs. 86,160·77	3,446	43
Furniture, Fittings and Office Equipment at $7\frac{1}{2}\%$ on Rs. 8,823·61	661	77
Water Supply at $7\frac{1}{2}\%$ on Rs. 5,751·94	431	40
Machinery and Tools at $7\frac{1}{2}\%$ on Rs. 70,324·57	5,274	34
Nivitigalakele Buildings at 4% on Rs. 27,437·11	1,097	48
Laboratory Apparatus Account at 25% on Rs. 12,200·46 (Culloden and Dartonfield)	3,050	11
	<u>Rs. 16,089</u>	<u>96</u>

19. *Provident Fund Reserve Account* — Rs. 23,848.—The particulars of the receipts and payments on this account are shown in the Provident Fund Account attached hereto. The balance standing to the credit of this fund at the beginning of the year was Rs. 16,413. The contributions made by the officers during the year amounted to Rs. 3,651 and those made from the funds of the Board amounted to Rs. 3,871. Of the amount contributed by the Board, Rs. 3,151 represents the bonus equivalent to the sum contributed by the officers during 1935 and Rs. 661 the interest due on the balance of the fund for 1936.

20. *Reserve Fund for Passages* — Rs. 5,217.—During the year a sum of Rs. 3,078 was paid out from this fund to meet the cost of passages provided to officers and members of their families. The amount transferred from the revenue of the Board during the year was the same as in the previous year, namely, Rs. 1,250.

21. *Surplus Account* — Rs. 154,467.—This sum represents the accumulated surplus of the Board at December 31, 1936. The surplus at the commencement of the year under review was Rs. 199,646. The excess of income over expenditure for the year was Rs. 45,706 but the amount incurred on Capital Expenditure was Rs. 113,423. There was therefore a deficit for the year of Rs. 67,717 which reduced the surplus to Rs. 131,929. This sum together with the amount realised on the sale of buildings, etc., at Culloden Estate and the amount of the cash reserve for their depreciation is shown as the cash surplus in the Balance Sheet.

*(b) Assets.***22. Culloden Estate.**

(1) *Building Account* — Rs. 5,500.—This sum represents the estimated value of the materials of the unsold buildings at

Culloden Estate. The other buildings were sold to the proprietors of the estate when the laboratories and the offices of the Board were transferred to Dartonfield Estate during the year. The sale realised a sum of Rs. 6,500 of which Rs. 500 was taken as the realisation value of the water supply. The loss on the sale after deducting the amount reserved for the depreciation of this asset amounted to Rs. 28,197.

(2) *Furniture, Fittings and Office Equipment* — Rs. 1,500.— This sum represents the cost of the furniture in the unsold bungalow at Culloden Estate. Furniture to the value of Rs. 7,967 was transferred to Dartonfield Estate.

23. **Dartonfield Estate.**

(1) *Property* — Rs. 101,594.—The balance on December 31, 1935, was Rs. 95,161. A sum of Rs. 6,433 was spent on the development and improvement of the property bringing the total cost to Rs. 101,594.

(2) *Buildings* — Rs. 156,070.—The balance on December 31, 1935, was Rs. 88,053. The cost of additional buildings and improvements made during the year amounted to Rs. 68,017 bringing the total cost of the buildings at Dartonfield to Rs. 156,070.

(3) *Furniture, Fittings and Office Equipment* — Rs. 22,601.— This sum represents the cost of the furniture, fittings and office equipment at Dartonfield Estate. The cost of furniture, etc., purchased during the year amounted to Rs. 5,518 and the book value of the furniture, etc., transferred from Culloden Estate amounted to Rs. 7,967 increasing the balance of this account at December 31, 1936, to Rs. 22,601.

(4) *Water Supply* — Rs. 22,339.—The balance on December 31, 1935, was Rs. 5,954. A sum of Rs. 16,385 was spent during the year on the supply and fittings to the Administration Block, Botanical Laboratory, Bungalows and on the Water and Lighting Scheme, making a total of Rs. 22,339.

(5) *Machinery and Tools* — Rs. 85,461.—The cost of the additional tools and experimental machinery purchased during the year amounted to Rs. 10,785, bringing the total to Rs. 85,461 at the close of the year.

24. **Nivitigalakele.**

(1) *Property* — Rs. 90,064.—The balance on December 31, 1935, was Rs. 85,395. The cost of agricultural development, the 1936 Nurseries and the development of the Pinnagoda new clearing during the year amounted to Rs. 4,669, making a total of Rs. 90,064.

(2) *Buildings* — Rs. 28,296.—The cost of the additions to the Factory during the year amounting to Rs. 859 increased the total cost of the buildings at December 31, 1936, to Rs. 28,296.

(3) *Water Supply* — Rs. 123.—This amount represents the cost of installing water service at Nivitigalakele.

(4) *Machinery and Tools* — Rs. 106.—This amount represents the cost of machinery and tools purchased during the year.

25. *Laboratory Apparatus Account* — Rs. 21,053.—The balance at December 31, 1935, was Rs. 20,525. The cost of additional apparatus purchased during the year amounted to Rs. 528 bringing the total cost of the apparatus to Rs. 21,053.

26. *London Plant Account* — Rs. 11,333.—This amount represents the balance carried forward from the previous year. No depreciation has been allowed by the Board for 1936.

27. *Advance Account* — Rs. 141.—Of this sum Rs. 95 represents the amount deposited with the Postmaster-General on account of telephone trunk calls and Rs. 46 the amount with Messrs. the Imperial Chemical Industries (India) Ltd.

28. *Sundry Assets at Culloden* — Rs. 7.—This amount represents the balance of cash in the hands of the Small-Holdings Propaganda Officer.

29. *Sundry Assets at Dartonfield* — Rs. 612.—Of this amount a sum of Rs. 224 represents the expenditure on the preparation of the site for the Director's bungalow chargeable to Capital Expenditure Account. This amount is shown as a sundry asset in the Balance Sheet pending its transfer against a vote to be obtained in 1937. Of the balance, Rs. 8 represents the unexpended balance of cash in the hands of the superintendent of the estate, Rs. 109, the value of the stock of rice and Rs. 271 the value of stores on the estate.

30. *Sundry Assets at Nivitigalakele* — Rs. 61.—This amount represents the unexpended balance of cash in the hands of the superintendent of the estate.

31. *Sundry Debtors Account* — Rs. 26,484.—Of this sum Rs. 10,092 was due from the Deputy Financial Secretary on account of cess collections made during December, 1936. This amount was received from him in January, 1937. The details of the items making up the balance on this account are given in the Balance Sheet. The stock of rubber with the London Committee kept for sale has been valued at Rs. 357.

32. *Equipment Advance Account* — Rs. 3,080.—The balance of the advance made to the London Committee at December 31, 1935, was Rs. 2,270. During the year a sum of Rs. 5,476 which was realised from the sales of crumb rubber and retained by the Committee was treated as

a further advance. The value of equipment supplied amounted to Rs. 4,666. The balance in the hands of the London Committee on this account at December 31, 1936, was therefore Rs. 3,080.

33. *Cash Account — Rs. 202,985.*—The receipts in support of the amounts lying in fixed deposit at banks were inspected, the balance in the current account at the National Bank of India, Ltd., Colombo, was verified by reference to the bank certificate and the pass book. The balance of cash in hand at December 31, 1936, was not verified but a surprise verification of the cash, etc., in hand was made on 25th February, 1937.

IV. General.

34. The accounts were received quarterly and examined in this office. A departmental verification of all the inventory articles was held and a report was forwarded to this office. The office of the Board at Dartonfield Estate was visited twice during the year and the books and accounts kept were checked and the cash in hand verified.

I am, Sir,
Your Obedient Servant,
J. JOS. JACOB,
Acting Auditor-General.

Audit Office,
Colombo, March 10, 1937.

RUBBER RESEARCH SCHEME (CEYLON).

Working A/c. of the Provident Fund for the Year Ended 31-12-36.

1936	Rs. cts.	1936.	Rs. cts.
Jany. 28. To Amount refunded to a retiring member	60 30	Jany. 1. By Balance brought forward from 1935	16,413 37
Mar. 27. Amount refunded to a retiring member	21 84	Board's Contribution for 1935	3,151 47
Apr. 30 Amount refunded to a retiring member	7 37	Interest for 1935 on Officers' Contributions	365 77
Dec. 31. Balance carried forward to 1937	23,847 89	Interest for 1935 on Board's Bonus A/c.	295 71
		Board's Contribution paid but not credited to this account in 1934	57 76
		Contributions received plus interest not brought to account in 1935	1 56
		Amount overcharged in 1935 now refunded	72
		Interest paid by Board on Contributions not credited in 1936	03
		Dec. 31 Members' Contributions in 1936	3,651 01
	<u>Rs. 23,937 40</u>		<u>Rs. 23,937 40</u>

Audited and found correct:

(Sgd.) J. JOS. JACOB,
Acting Auditor-General,

Audit Office,
Colombo, 10th March, 1937.

(Sgd.) E. RODRIGO,
Chairman,

Board of Management,
Rubber Research Scheme, (Ceylon).

Income and Expenditure Account for the Year Ended 31-12-36.

DR.		CR.	
	Rs. cts.		Rs. cts.
To Personal Emoluments:—		By Cess Collections	
Salaries of Technical Officers	53,669 75	Received Jany.-Nov.	130,441 34
Salary of Secretary to the Director	3,000 00	Due for Dec.	10,091 68
Salaries of Subordinate Staff	7,761 91		140,533 02
Rent Allowances	631 21	Interest on Fixed Deposits and Current Account	4,197 92
Provident Fund Contribution	3,872 30	Sale of Publications	501 18
	68,935 17	Sundry Receipts	409 59
Other Charges:—		Receipts from sale of Dartonfield rubber	41,993 73
Upkeep of Laboratory, Chemicals and Apparatus	2,409 31	Rubber in Stock (London) 1,190 lbs. @ -/30	357 00
Sulphur Dusting Experiments	39 99		42,350 73
Upkeep of Buildings Insurance	277 33	Less expenditure on Dartonfield Normal Working	16,086 05
Upkeep of Water Supply	453 45		26,264 68
Upkeep of Roads	62 24	Receipts from sale of Nivitigalakele rubber, budwood, budded stumps and cover crop seed	10,047 27
Furniture Replacements	45 64	Less expenditure on Revenue Account	4,267 36
	2,134 50		5 779 91
Printing and Advertising	1,907 57		
Stationery	1,391 10		
Postages	1,262 13		
Books & Periodicals	732 78		
General Charges	821 38		
Audit and Accountancy	493 88		
Telephones	1,123 50		
	7,732 34		
Travelling Expenses of Staff	5,879 80		
Travelling Expenses of Board Members	987 27		
	6 867 07		
Contribution to expenditure of London Advisory Committee for Rubber Research (Ceylon & Malaya)	18,570 04		
Passage Fund Reserve (Contribution)	1,250 00		
Dartonfield Estate Experimental Account	7,952 43		
Depreciation:—			
Culloden Estate:—			
Buildings @ 4% on Rs. 39,596.84	1,587 87		
Furniture, Fittings and Office Equipment @ 7½% on Rs. 5,804.86	435 36		
Water Supply @ 7½% on Rs. 1,402.62	105 20		
Dartonfield Estate:—			
Buildings @ 4% on Rs. 86,160.77	3,446 43		
Furniture, Fittings and Office Equipment @ 7½% on Rs. 8,823.61	661 77		
Water Supply @ 7½% on Rs. 5,751.94	431 40		
Machinery and Tools @ 7½% on Rs. 70,324.57	5,274 34		
Nivitigalakele Buildings @ 4% on Rs. 27,437.11	1,097 48		
Laboratory Apparatus Account @ 25% on Rs. 12,200.46	3,050 11		
	16,089 96		
Balance, being excess of Income over Expenditure for the year carried forward to the Balance Sheet	45,705 49		
	<u>Rs. 177,686 30</u>		<u>Rs. 177,686 30</u>

Audited and found correct:

(Sgd.) J. JOS. JACOB,
Acting Auditor-General,

Audit Office,
Colombo, 10th March, 1937.

(Sgd.) E. RODRIGO,
Chairman,

Board of Management,
Rubber Research Scheme, (Ceylon).

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1936.

LIABILITIES			ASSETS		
	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
Contribution to Capital Outlay:—			CULLODEN ESTATE:—		
As per Balance Sheet, December 31, 1935 ...	482,561 14		Buildings Account:—		
Less value of Culloden Buildings and Water Fittings written off ...	49,944 31		As per Balance Sheet, December 31, 1935 ...	53,039 99	
	432,616 83		Less value of Buildings sold ...	6,000 00	
Additions during 1936 ...	113,422 85	546,039 68	Less Depreciation reserved since 1930 ...	47,039 99	
Sundry Creditors ...		5,311 37		13,343 15	
Electric Light Account ...		361 79	Less loss transferred to Capital Outlay ...	33,696 84	
Deposit for Supply of Budwood and Budded Stumps in 1937 ...		776 88		28,196 84 (A)	5,500 00
Deposit for Supply of Cover Crop Seed in 1937 ...		49 00			
Sulphur Dusting Scheme by Government Grant:—			Furniture, Fittings & Office Equipment:—		
Government Grant ...	20,000 00		As per Balance Sheet, December 31, 1935 ...	9,466 83	
Payments by Estate Proprietors ...	550 00		Less Furniture transferred to Dartonfield Buildings ...	7,966 83	1,500 00
	20,550 00				
Less expenditure to end of December ...	15,049 04	5,500 96	Water Supply:—		
Depreciation Cash Reserve Account:—			As per Balance Sheet, December 31, 1935 ...	2,404 32	
As per Balance Sheet December 31, 1935 ...	37,785 92		Less value of water fittings sold ...	500 00	
Less Depreciation reserved against Culloden Buildings & Water Supply since 1930 transferred to Surplus Account ...	16,037 92			1,904 32	
	21,748 00		Less Depreciation reserved since 1930 ...	1,001 70	
Add Depreciation allowed in 1936 ...	16,089 96	37,837 96		902 62	
Provident Fund Reserve Account:—			Less loss transferred to Capital Outlay ...	902 62 (B)	—
As per Balance Sheet, December 31, 1935 ...	16,413 37		DARTONFIELD ESTATE:—		
Additions during 1936 ...	7,434 52	23,847 89	Property:—		
Reserve Fund for Passages:—			As per Balance Sheet, December 31, 1935 ...	78,337 36	
As per Balance Sheet, December 31, 1935 ...	7,045 06		Expenditure on Agricultural Development as per Balance Sheet, December 31, 1935 ...	4,797 68	
Less expenditure on passages in 1936 ...	3,078 02		Add expenditure during 1936 ...	2,775 25	7,572 93
	3,967 04		Expenditure on Fencing, Roads, Survey, etc., as per Balance Sheet, December 31, 1935 ...	12,025 65	
Additions during 1936 ...	1,250 00	5,217 04	Add expenditure during 1936 ...	3,657 83	15,683 48
Surplus Account:—					101,593 77
Balance as per Balance Sheet, December 31, 1935 ...	199,646 26		Buildings:—		
Add amount transferred from Depreciation Reserve Account, being Depreciation on Culloden Buildings and Water Supply reserved since 1930 ...	16,037 92		Factory:—		
Add value realised by sale of Culloden & Heatherley Buildings and Water Fittings, etc. ...	6,500 00		As per Balance Sheet, December 31, 1935 ...	28,290 34	
Add excess of Income over Expenditure for the year 1936 ...	45,705 49		Chemical Laboratory—		
	267,889 67		As per Balance Sheet, December 31, 1935 ...	9,670 01	
Less amount transferred to Contribution to Capital Outlay ...	113,422 85	154,466 82	Administration Block ...	12,183 61	
			Botanical Laboratory—		
			As per Balance Sheet, December 31, 1935 ...	417 83	
			Additions in 1936 ...	13,823 95	14,241 78
			Bungalows—		
			As per Balance Sheet, December 31, 1935 ...	49,674 74	
			Less value of Estate Buildings transferred ...	27,314 34	
				22,360 40	
			Additions in 1936 ...	38,605 67	60,966 07
			Estate Buildings—		
			Amount transferred from Bungalows ...	27,314 34	
			Additions in 1936 ...	3,403 60	30,717 94
					156,069 75
			Furniture, Fittings & Office Equipment:—		
			Factory:—		
			As per Balance Sheet December 31, 1935 ...	1,166 15	
			Vulcanizing Equipment—		
			As per Balance Sheet December 31, 1935 ...	357 40	
			Administration Block ...	2,039 90	
			Chemical Laboratory—		
			As per Balance Sheet December 31, 1935 ...	3,542 99	
			Botanical Laboratory—		
			As per Balance Sheet December 31, 1935 ...	101 40	
			Add value of Furniture transferred from Culloden ...	2,466 83	
			Additions in 1936 ...	1,163 37	3,731 60
			Bungalows—		
			As per Balance Sheet December 31, 1935 ...	3,947 32	
			Add value of Furniture transferred from Culloden ...	4,000 00	
			Additions in 1936 ...	3,815 42	11,762 74
					22,600 78
			Water Supply:—		
			Factory:—		
			As per Balance Sheet December 31, 1935 ...	2,485 50	
			Chemical Laboratory—		
			As per Balance Sheet, December 31, 1935 ...	1,559 00	
			Administration Block ...	280 00	
			Botanical Laboratory ...	1,910 21	
			Bungalows—		
			As per Balance Sheet, December 31, 1935 ...	1,774 54	
			Additions in 1936 ...	7,229 28	9,003 82
			Water & Lighting Scheme—		
			As per Balance Sheet, December 31, 1935 ...	135 25	
			Additions in 1936 ...	6,965 38	7,100 63
					22,339 16
			Machinery & Tools:—		
			Factory:—		
			As per Balance Sheet, December 31, 1935 ...	37,571 52	
			Administration Block ...	396 00	
			Chemical Laboratory—		
			As per Balance Sheet December 31, 1935 ...	8,841 19	
			Botanical Laboratory ...	1,780 58	
			Vulcanizing Equipment—		
			As per Balance Sheet, December 31, 1935 ...	25,821 26	
			Bungalows—		
			As per Balance Sheet December 31, 1935 ...	652 00	
			Additions in 1936 ...	2,151 64	2,803 64
			Experimental Machinery—		
			As per Balance Sheet December 31, 1935 ...	1,789 92	
			Additions in 1936 ...	6,456 61	8,246 53
					85,460 72
			NIVITIGALAKELE:—		
			Property:—		
			As per Balance Sheet, December 31, 1935 ...	85,395 08	
			Add cost of Agricultural Development during 1936 ...	3,146 37	
Carried over	Rs. 779,409 39		Carried over	Rs. 88,541 45	395,064 18

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1936.—Contd.

LIABILITIES

	Rs. cts.
Brought forward	Rs. 779,409 39

ASSETS

	Rs. cts.	Rs. cts.
Brought forward	88,541 45	395,064 18
Add Pinnagoda New Clearing Development during 1936	875 26	
Add 1936 Nurseries	647 58	
		90,064 29
Buildings:—		
As per Balance Sheet, December 31, 1935	27,437 11	
Additions in 1936 (Factory)	858 52	
		28,295 63
Water Supply		123 1 ⁵
Machinery and Tools		105 50
GENERAL:—		
Laboratory Apparatus Account:—		
As per Balance Sheet, December 31, 1935	20,525 42	
Add purchases during 1936	528 17	
		21,053 59
London Plant Account:—		
As per Balance Sheet, December 31, 1935		11,333 34
Advance Account:—		
On Deposit with Postmaster-General as per Balance Sheet December 31, 1935	95 00	
On Deposit with Messrs. The Imperial Chemical Industries (India) Ltd., as per Balance Sheet, December 31, 1935	46 00	
		141 00
Sundry Assets at Culloden:—		
Cash in hand with the Small-Holdings Propaganda Officer		7 38
Sundry Assets at Dartonfield:—		
Cash in hand	8 15	
Rice in hand	109 04	
Stores in hand	270 89	
Director's Bungalow	224 02	
		612 10
Sundry Assets at Nivitigalakele:—		
Cash in hand		60 53
Sundry Debtors Account:—		
Cess Collections for December	10,091 68	
Interest accrued on Fixed Deposits	1,654 10	
Profit from Dartonfield Estate	5,191 62	
Nivitigalakele Revenue from sale of Budwood and Rubber	1 493 68	
Books and Periodicals—for booklet sold	5 00	
Overpayment to Staff	85	
Dartonfield Nursery 1934 for budded stumps sold	14 25	
Sundry Receipts for Advertisement Charges, &c.	122 18	
Sale of Culloden Buildings	6,500 00	
Dartonfield Normal Working	270 00	
Dartonfield Senior Staff Bungalow No. 3	43 00	
Dartonfield Water and Lighting Scheme	147 00	
Sale of Publications	4 00	
Dartonfield Advance Account for labour lent	583 33	
Value of Rubber in stock (London)	357 00	
		26,483 71
Equipment Advance Account:—		
(London Advisory Committee)		
Balance as per Balance Sheet December 31, 1935	2,270 34	
Add value of Crumb Rubber, &c., sold during 1936 retained in London	5 476 04	
		7 746 38
Less value of Equipment supplied	4,066 74	
		3,079 64
Cash:—		
In Fixed Deposit with Imperial Bank of India	30,000 00	
In Fixed Deposit with Hongkong and Shanghai Banking Corporation	20,000 00	
In Fixed Deposit with Chartered Bank of India, Australia & China	50,000 00	
In Fixed Deposit with National Bank of India, Ltd.	75,000 00	
In Current Account with National Bank of India, Ltd.	27,492 93	
In hand	492 42	
		202,985 35
		Rs. 779,409 39

Rs. 779,409 39

I hereby certify that the Accounts of the Rubber Research Scheme (Ceylon) for the year 1936, have been audited and that in my opinion the above Balance Sheet correctly sets forth the position of affairs as shown by the books at December 31, 1936.

(Sgd). J. JOS. JACOB,
Acting Auditor-General.

Audit Office,
Colombo, 10th March, 1937.

(Sgd). E. RODRIGO,
Chairman.

Board of Management,
Rubber Research Scheme (Ceylon)

(A) CULLODEN ESTATE:—

Buildings Account:—

If allowance is made for depreciation reserved in 1936 (Rs. 1,587-87) the loss on sale of buildings is reduced to Rs. 26,608-97.

(B) CULLODEN ESTATE:—

Water Supply:—

If allowance is made for depreciation reserved in 1936 (Rs. 105-20) the loss on sale of water fittings is reduced to Rs. 797-42.

ESTIMATES FOR 1937.

(Adopted by the Board, November 12th, 1936)

REVENUE STATEMENT.

				Rs.	cts.
1.	Cess Collections	..	..	147,420	00
2.	Interest	..	..	2,000	00
3.	Sale of Publications	...	...	400	00
4.	Profit from Dartonfield Estate	..		12,500	00
5.	Profit on Revenue Account from Nivitigalakele Experiment Station	...		440	00
6.	Sundry Receipts	..	..	1,000	00
				<u>Rs. 163,760</u>	<u>00</u>

EXPENDITURE STATEMENT.

	Rs.	cts.	Rs.	cts.
1. Personal Emoluments:—				
Salaries and Wages			73,607	00
2. Laboratory:—				
(a) Upkeep, Chemicals and Apparatus	3,000	00		
(b) Samples for London Experiments	50	00		
(c) Upkeep of Experimental Machinery	1,000	00	4,050	00
3. Buildings:—				
(a) Upkeep of Buildings	200	00		
(b) Insurance	700	00		
(c) Upkeep of Power & Water Supply	100	00		
(d) Furniture Replacements	50	00	1,050	00
4. Office:—				
(a) Printing and Advertising	1,250	00		
(b) Stationery	2,350	00		
(c) Postages	1,700	00		
(d) Books and Periodicals	600	00		
(e) General Charges	750	00		
(f) Audit and Accountancy	550	00		
(g) Telephones	1,000	00	8,200	00
5. Travelling:—				
(a) Travelling expenses of Staff	3,000	00		
(b) Travelling expenses of Board Members	1,250	00	4,250	00
6. Special Charges:—				
London Advisory Committee's expenditure			12,000	00
7. Contribution to Passage Fund Reserve			1,250	00
8. Depreciation			18,000	00
9. Dartonfield Estate:—				
Expenditure on Experiments			9,693	00
10. Small-Holdings Work			3,882	00
Carried over			135,982	00

	Rs.	cts.	Rs.	cts.
Brought forward			135,982	00

11. Special Items of Expenditure on Capital

Account: Dartonfield Estate:—

Buildings :—

(a) Director's Bungalow	...	20,000	00	
(b) Bungalow of Secretary to the Director		10,000	00	
(c) 1 Junior Staff Bungalow	...	4,500	00	
(d) Superintendent's Office	...	2,500	00	37,000 00
Experimental Machinery	...	...		2,000 00
Water and Power Scheme	...	...		2,500 00

Field Works, etc. :—

Upkeep of Immature Areas	...	992	00	
Bridge to No. 5 Field	...	130	00	1,122 00

Nivitigalakele :—

Buildings :—

Small-Holdings Propaganda Officer's Bungalow		17,000	00	
One Junior Staff Bungalow	...	4,500	00	21,500 00

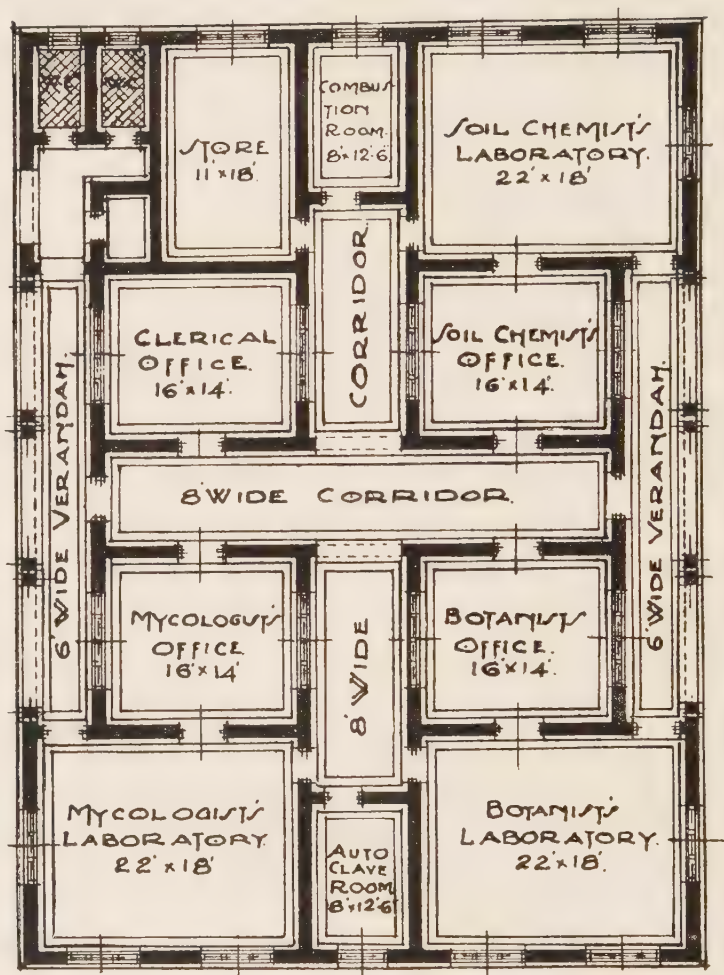
Field Works, etc. :—

Agricultural Development	...	...		4,950 00
Total			Rs.	205,054 00

SUMMARY.

Estimated total Income during 1937	...	163,760	00
Estimated total expenditure during 1937	...	205,054	00
Estimated excess of expenditure over Income during 1937.		Rs.	41,294 00

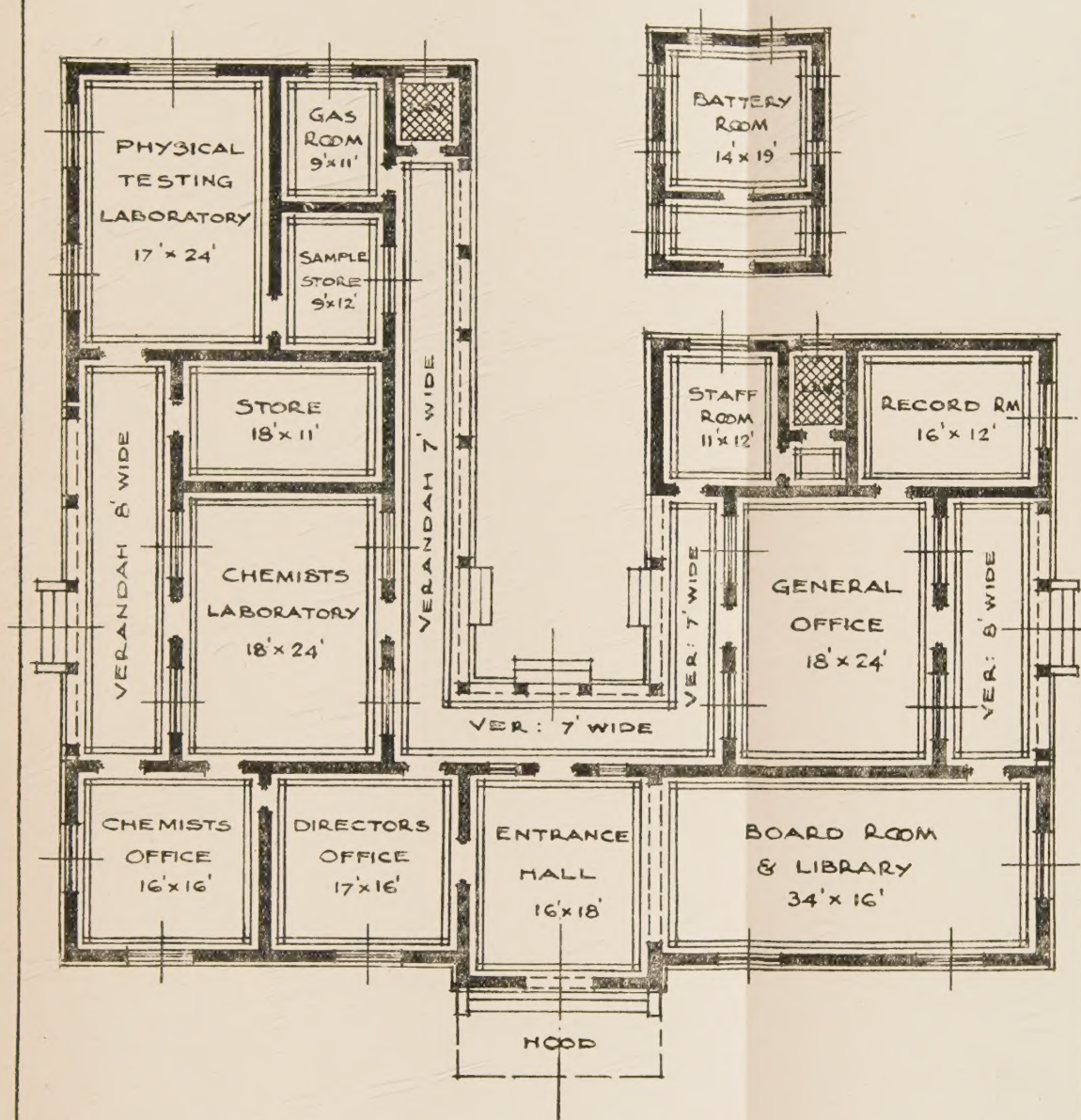
RUBBER RESEARCH SCHEME (CEYLON) BOTANICAL BLOCK.



— PLAN —

BILLIMORIA & de SILVA, A.R.I.B.A.
ARCHITECTS, IMPERIAL BANK
BUILDINGS, COLOMBO.

'RUBBER RESEARCH SCHEME (CEYLON)
CHEMICAL & ADMINISTRATION BLOCK



PLAN

BILLIMORIA & DE SILVA A.R.I.B.A.
 ARCHITECTS, IMPERIAL BANK
 BUILDINGS, COLOMBO

